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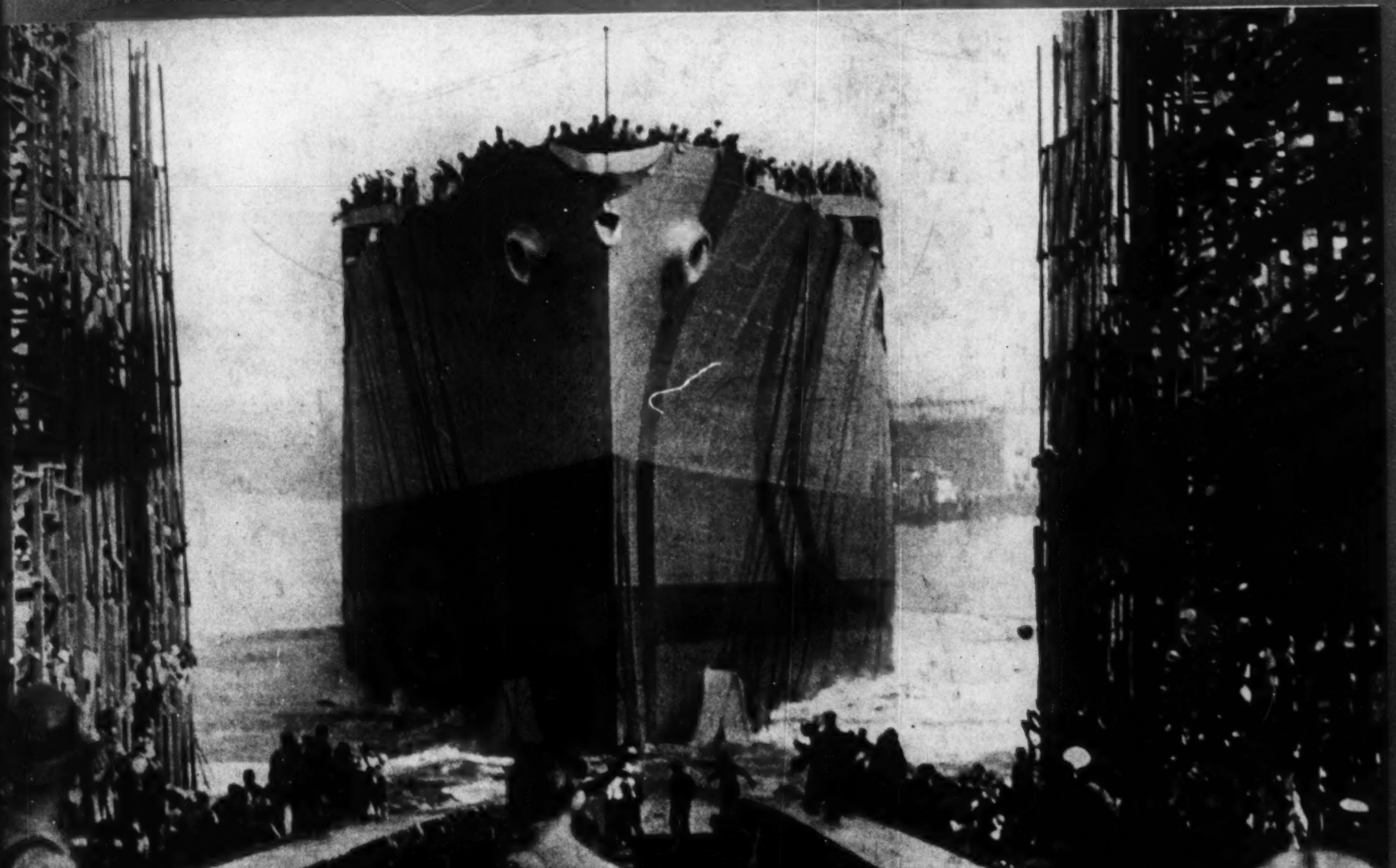

Ventilation is vital in efficient and speedy shipbuilding

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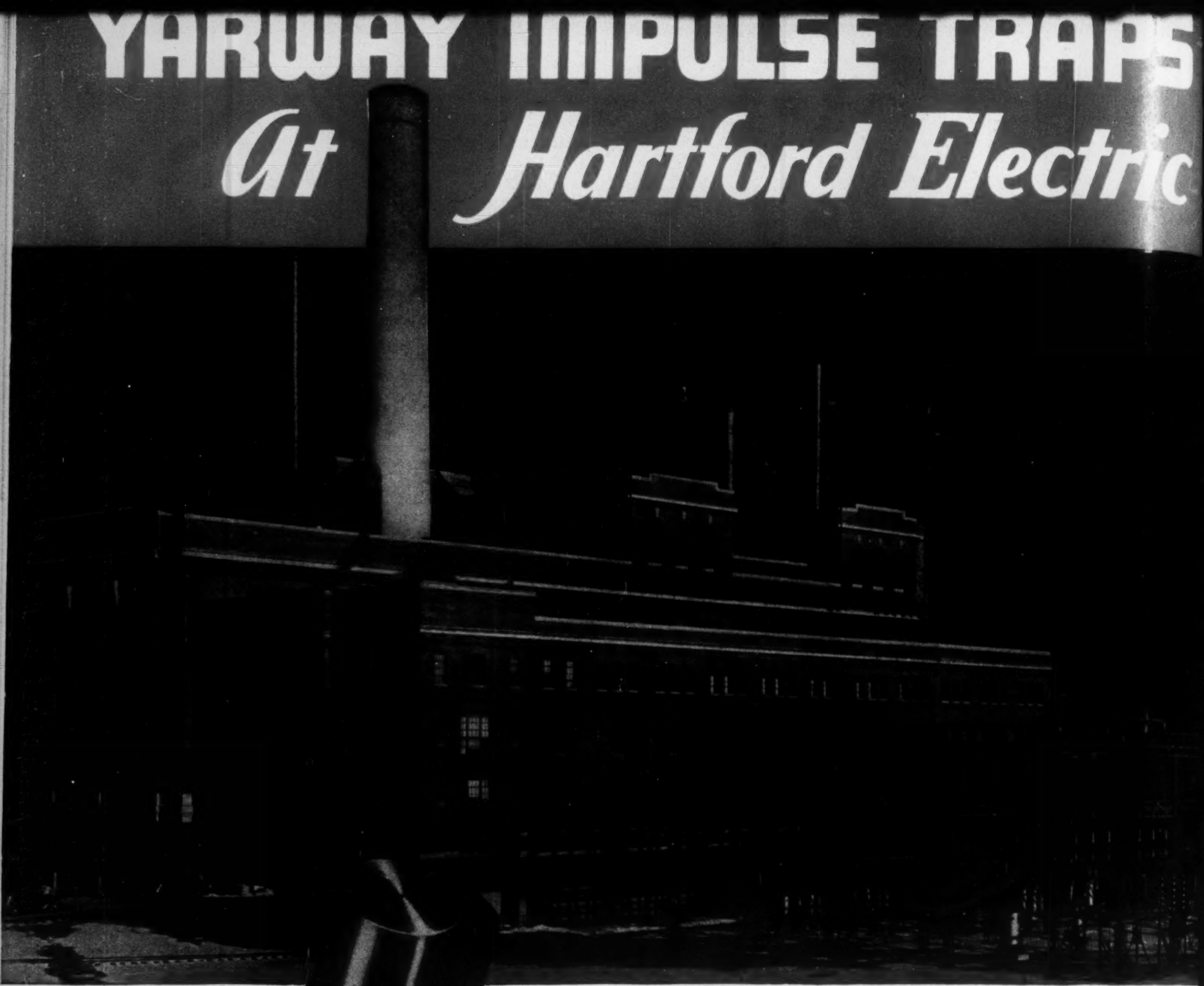
YARWAY IMPULSE TRAPS

At Hartford Electric



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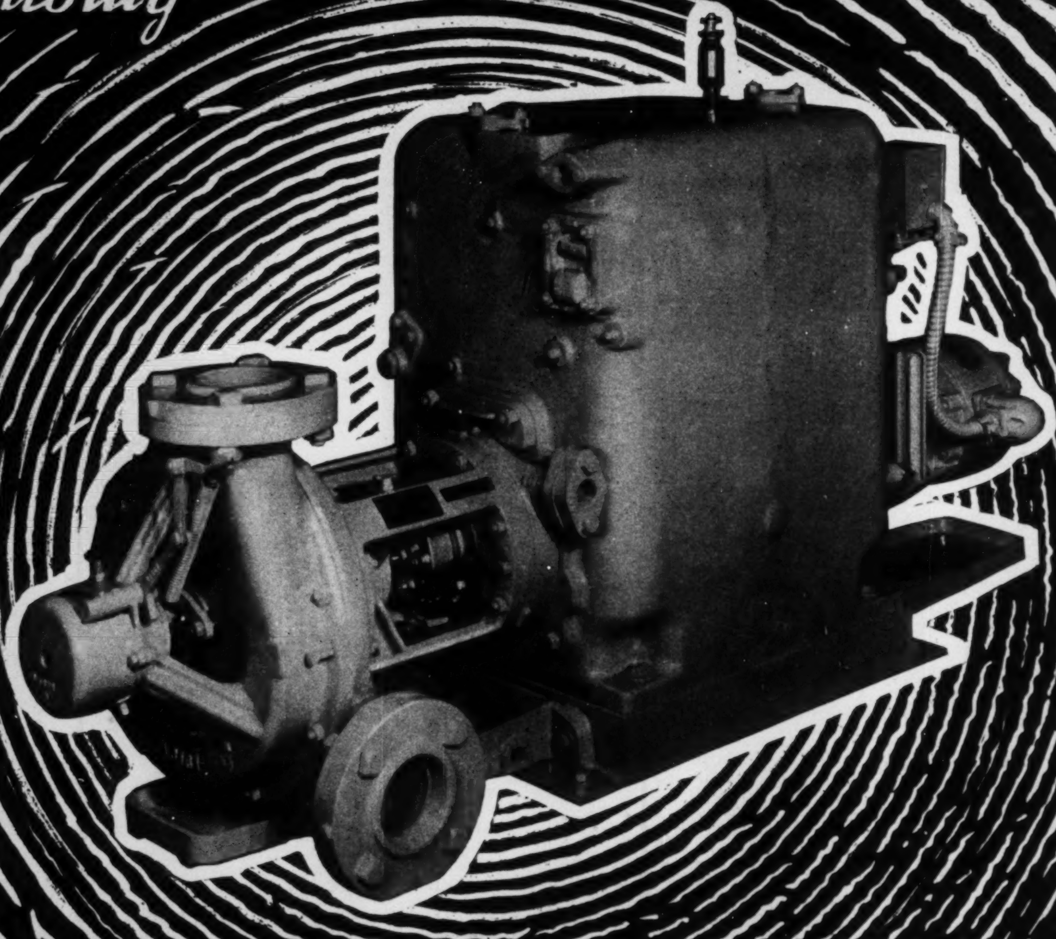
Centralized
Heating
Economy



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Simple, compact, one moving element, no wearing parts, no internal lubrication. Bulletin No. 203 gives the facts. Your copy is waiting.

THE NASH ENGINEERING COMPANY
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VENTILATION FOR SHIPS UNDER CONSTRUCTION

H. E. Packard, Shipbuilding Safety Engineer, Gives 'How to Do It' Information for Exhaust of Fumes, Compartment Ventilation, and Ventilating Closed Spaces During Painting

SUMMARY—Local exhaust of welding and burning fumes and carbon monoxide, general ventilation of compartments, and supply air masks for painters working in closed spaces are required in shipbuilding. Mr. Packard—of the Los Angeles Shipbuilding and Drydock Corp.—tells how these problems are handled at his yard, giving test results on various factors involved and practical suggestions for design, installation, and operation . . . Shipbuilding is of course one of the vital elements of our war effort; properly designed and operated ventilation for ships under construction is an essential to efficient and speedy shipbuilding

SHIPBUILDING VENTILATION presents three problems: local exhaust of welding and burning fumes and carbon monoxide; general ventilation of compartments, including both supply and exhaust; and supply air masks to painters working in closed compartments with paints containing petroleum spirits.

Exhaust and Supply Needed

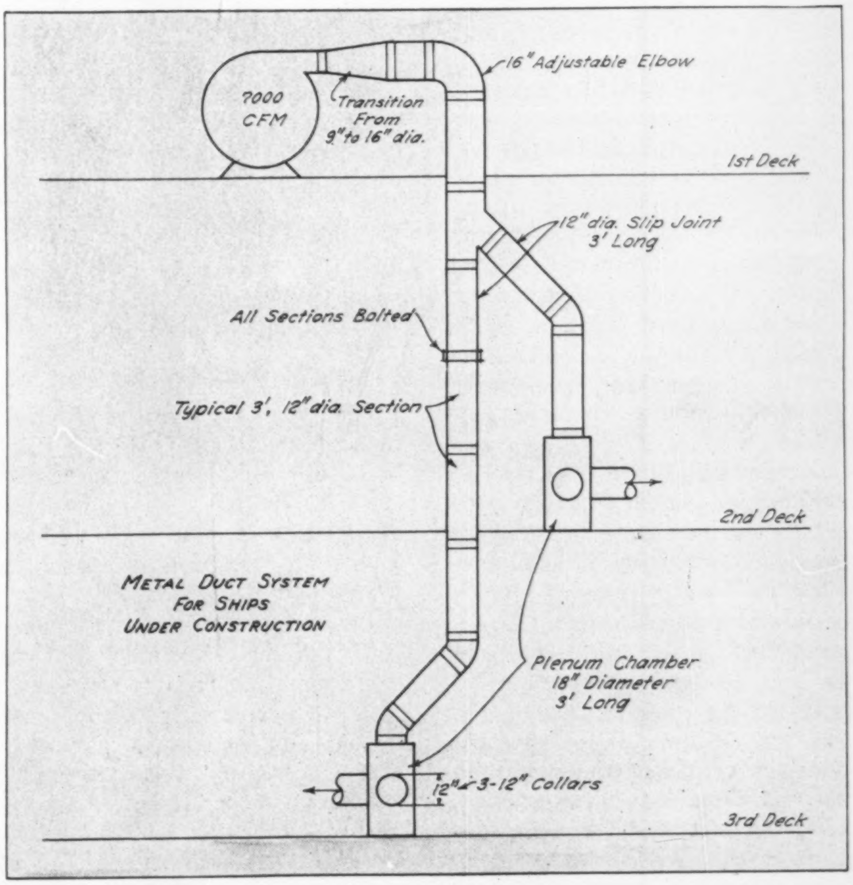
In almost every case where ventilation is required to provide proper working conditions, exhaust blowers, as well as supply blowers, should be used. The purpose of the exhaust blower is to remove dusts, fumes, vapors, or gases from the immediate locality of origin. Supply blowers are used to supply adequate outside air. It is not feasible or practical to use exhaust blowers only to fulfill the duties that the combination supply and exhaust system can perform.

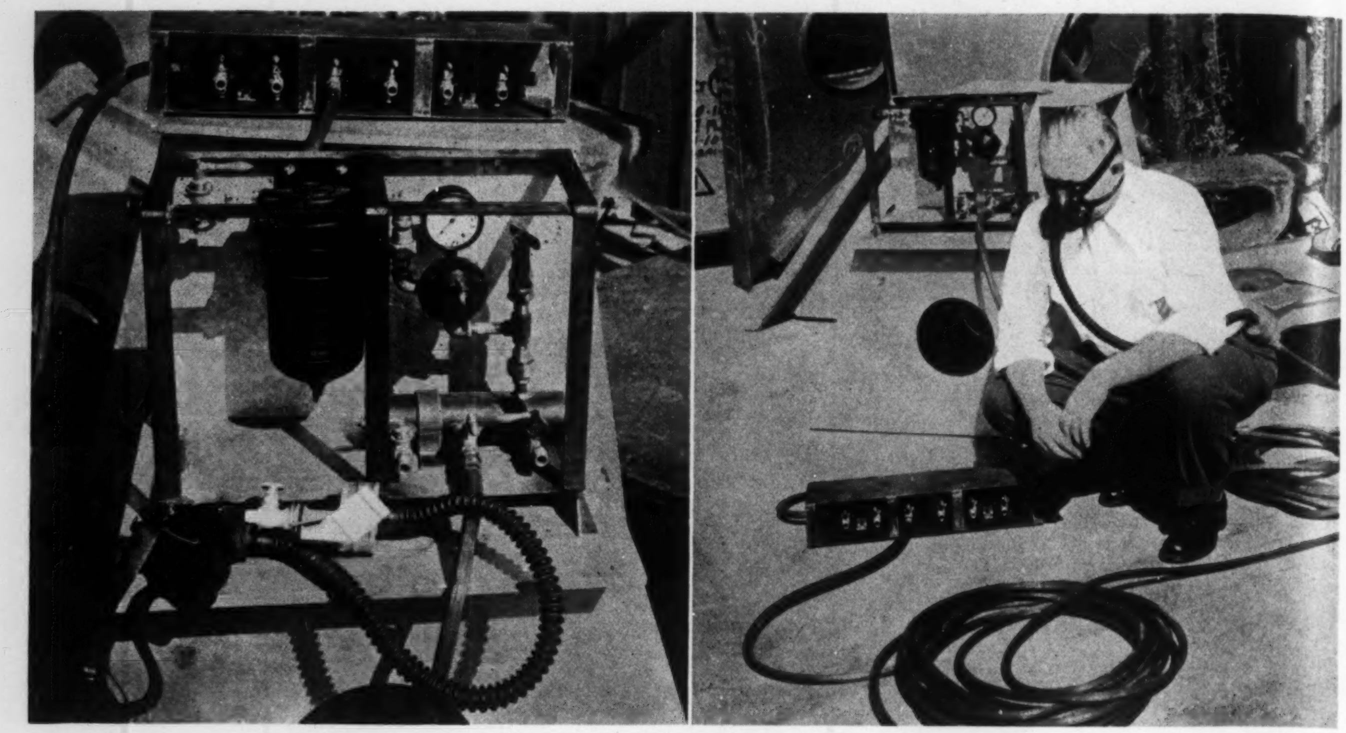
For example, let us take a wing tank below the third deck and try to ventilate it with an exhaust system only. From observation, the following will be found. The exhaust blower will exhaust the fumes from the air in the immediate locality of origin, but, in turn, will draw air from adjoining compartments into the original one, which may also be contaminated. Air is always pulled through the path of least resistance, and this would, in most cases, be from compartments or enclosures closest to the entry connection of the exhaust line.

Extensive experiments aboard two hulls under construction were made, and it was found that the cheapest and best ventilation was accomplished by supplying air directly from the outside, as well as using exhaust equipment where burners, welders, cutters, painters, etc., were working. The question of supply versus exhaust was settled when it was found that air in motion in following the line of least resistance was only effective in localized areas (in the case of the exhaust method alone). In the case of the supply system, it was found that by forcing air into various compartments where it was most required, bad air was displaced with outside air, and we were able to increase immediately the oxygen content of the compartment, at the same time avoiding "dead spots," which are impossible to prevent when using only exhausting equipment. In no case where a certain locality was cleaned up was there a problem of directing bad air from surrounding compartments, a condition encountered when exhausting equipment to provide complete ventilation was used.

Tests Show Duct Requirements

Working on the premise that prevention of poisoning through toxic fumes, dust, smoke, etc., means remove them at the source, a special


7000 CFM
Transition From 9" to 16" dia.
16" Adjustable Elbow
1st Deck
12" dia. Slip Joint 3' Long
All Sections Bolted
Typical 3', 12" dia. Section
2nd Deck
METAL DUCT SYSTEM FOR SHIPS UNDER CONSTRUCTION
Plenum Chamber 18" Diameter 3' Long
12"
3-12" Collars
3rd Deck



A unit has been developed for supplying air to painters while working in closed compartments. The unit can be placed in the compartment where painters are working, or close by manholes leading into double bottoms

tank 6 by 6 by 6 ft in size was constructed with only one 16 in. opening to represent a lightning hole. Several tests were made while welding on a 3 in. by 3 in. zinc plate, on galvanized metal, and on black iron. These tests were made in close collaboration with the Los Angeles city hygiene department, who took most of the metal fume samples with an electrostatic precipitator and others with a Greenburg-Smith Impinger. A 700 cfm exhauster with two 3 in. ports and two 50 ft sections of flexible tubing to each side were used. It was found when using one duct and blocking off the other that the air delivery was about 450 cfm. When two ducts were used, cfm was reduced to 200 per duct.

Without exhaust, the lead content of air in the compartment was 44.0 mgm per 10 cubic meters of air. The zinc content was 1020 mgm per 10 cubic meters of air. Arsenic showed 0.2 mgm per 10 cubic meters of air, and a trace of nitrous oxide was present. With the exhaust duct 10 in. to 12 in. from the arc, the lead content was 1.6 mgm per 10 cubic meters of air. Zinc was 18.2 mgm per 10 cubic meters of air, and there was no trace of arsenic or nitrous oxide. When the duct mouth was placed 6 in. from the arc, the lead content was 0.44 mgm per 10 cubic meters of air. Zinc was cut down to 9.2 mgm per 10 cubic meters of air, and, of course, there was no trace of arsenic or nitrous oxide. The maximum safe limit on lead is 1.5 mgm per 10 cubic meters of air, and with zinc it is 150 mgm per 10 cubic meters of air. There is no safe limit for arsenic or nitrous oxide. As a result of these tests, orders were given for welders to keep their duct mouths within 6 in. of the arc, and not to use over 50 ft of duct. When 50 ft of duct will not reach, the exhauster is placed nearer to the welder and the exhaust is run into a 12 in. duct and vented to atmosphere.

Metal Duct Construction

The type of general ventilation found most suitable is (as previously stated) supply and exhaust, using sheet metal ducts made from No. 22 U.S. standard gage galvanized iron. Our ducts are designed for 7000 cfm blowers, when operating against a 2 in. water column static pressure. The chief problem confronted in using any metal duct system for temporary ventilation is to so design the duct as to make it highly portable and easy to install and disassemble. This was accomplished by having all duct fabricated in 3 ft sections with metal clips at both ends so it can be easily bolted together. The system under discussion has only two sizes of pipe, 16 in. diameter and 12 in. diameter. One size Y is used; this is a reduction from 16 in. to two 12 in. diameters. Two size elbows are used, 12 in. and 16 in. in diameter. At the termination of each branch there is a plenum chamber which is 18 in. in diameter and 3 ft high. This plenum chamber has three 12 in. diameter openings and is used as a supply outlet, as well as a manifold to supply air to adjoining compartments.

This metal duct has proved itself ideal in actual operation aboard ship. There are very few locations that cannot be serviced with this equipment. The chief advantage of metal duct over canvas duct is that the cross sectional area of the pipe can be maintained while going around corners, over plates, etc.; the pressure drop is therefore reduced, with a consequent increase in air delivery to the locations where air is needed. The metal duct is more durable than canvas duct, and its lifetime is approximately six months or more.

Two Types of Fans Used

When it is necessary to get air into a rather inaccessible place, two types of fans are used. One is a

2500 cfm radial type fan, single width, single inlet, which operates against 4 in. static pressure. This fan can be used in compartments having small manholes through the use of 8 in. noncollapsible, flame resistant duct. It is also adaptable for a central exhaust system as it will handle about eight lengths of 50 ft, 3 in. exhaust tubing for welders. The other is an 800 cfm axial flow fan, single width, single inlet, which is used with a short length of 8 in., noncollapsible, fire resistant duct. This fan can be used either for exhausting a small chamber, or for introducing outside air. The duct should not be over 10 or 15 ft long.

Ventilating the Double Bottoms

Occasionally it is necessary to do some work in the double bottoms after the ship is in an advanced stage of construction. If the manhole is close to a plenum chamber, which is being used for general ventilation of a large compartment such as an engine room, the axial flow fan can be hooked up to the plenum chamber to act as a booster to bring air to the location in the double bottom where it is necessary to work. It is not practical to hook an 8 in. duct direct to the plenum chamber as delivery will be almost nil. The application of the above described system, will, of course, have to be changed according to the individual needs to be met. The size of general ventilation duct explained is based on 7000 cfm fans. If this size of duct is too large for ventilation needs, then the ratio can be determined through reference to a chart showing friction of air in pipes. This type of chart can be found in the Heating, Ventilating, Air Conditioning Guide published by the American Society of Heating and Ventilating Engineers.

It is strongly recommended that, wherever possible, a ventilation engineer be called in to set up the system, as good ventilation is dependent upon a certain required amount of air changes per hour. Eighteen to 20 air changes per hour have been found sufficient to meet almost any condition in the shipbuilding industry.

Painting in Closed Compartments

Another problem to be met is supplying air to painters while working in closed compartments. A small, compact unit servicing 12 masks has been worked out. The unit can be placed in the compartment where the painting is to be conducted, or close by manholes leading into double bottoms. A regular 1 in. air line is used as a source of supply direct from an air receiver, air line, or an air compressor. It enters through a self-bleeding air cock into an air filter and then through a pressure regulator and safety valve to a small disbursing chamber made from a short length of 3 in. pipe. The one in the accompanying picture has three ¼ in. air cocks, which, in turn, were intended to supply three manifolds also made from a piece of 3 in. iron pipe. Each of these manifolds was intended to service six respirators. Originally, this unit was expected to supply 18 masks; however, it was found, after experimenting with air at the 100 psi line pressure available, that the number of masks serviced had to be cut to 12, so two cocks instead of the original three are now used in the first disbursement chamber. If fewer masks are to be used, the regulator should be adjusted accordingly. Regular ¼ in. oxygen hose is used in 25 ft lengths to service the manifolds and air line respirators. It is also suggested that the respirators have an auxiliary regulator and carbon filter. As far as is known, the principle of this filter unit is not patented. The idea was gotten from a recommended setup by the Bureau of Mines.

WANTED—YOUR IDEAS!

As the Treasury Department's special six weeks' war bond payroll savings campaign progresses from November 15 to New Year's Day, the war savings staff is anxious to secure as many ideas as possible on how different companies are planning to put across their individual drives for 10 per cent of payroll.

These ideas in turn will be passed on to other companies to aid them in reaching the mutual objective before New Year's Day.

The continued success of the war savings campaign depends upon the payroll savings plan. Consequently, the war savings staff is trying to complete the job of signing up every wage earner for 10 per cent through the payroll savings plan not later than the first day of 1943.

Help the national campaign first by putting over the drive in your own company, and then by telling the war savings staff how you did it. Send this vital information to Payroll Savings Division, War Savings Staff, Treasury Department, 709 12th St., N. W., Washington, D. C.

Ventilation Engineer Needed

When the shipbuilding company decides that a ventilation system should be installed, it should be remembered that ventilation of ships under construction is a technical problem which should be handled by a competent ventilation engineer who should remain in charge after it has been worked out, as new problems are presented from day to day according to needs as the construction progresses. It must also be remembered that a ventilation system is only as good as the crew maintaining it. The equipment is costly and should be properly supervised at all times. The provision of ventilation for the shipbuilding industry is not too difficult if properly handled. The trouble has been in too many cases that persons who know little or nothing about ventilation problems have been charged with the responsibility of ordering and setting up some type of ventilation system. Consequently, it often has been pretty much of a hit and miss proposition.

When the original cost of installation of an adequate system is learned, plus cost of maintenance, it is very easy to become alarmed and try to get by with a considerably less expensive substitute. In using the less expensive method, it may not be realized that hidden production costs are created that would pay for good ventilation many times over. To cite an example: A test was being run on air delivery, fumes, etc., in a rather small compartment in the aft end of a ship well along in construction. There were six welders and a burner working in the compartment at the time. The ventilation system for this compartment consisted of 1900 cfm supply and 2400 cfm exhaust. The temperature of the compartment with both supply and exhaust was 87 F. After shutting off the supply for 10 min but continuing with the exhaust, the temperature rose to 118 F. It stands to reason that production will suffer when men have to work in such a temperature. Production also suffers when men lose time from work as the result of metal fume fever contracted while welding or burning on galvanized iron without proper ventilation.

Deficiency of Oxygen

Another problem that had quite a bit to do with production, and at least as much to do with personnel relations, came up and was quite puzzling for a while. Men would come out of the engine rooms, condenser rooms, and many other compartments well down inside of the ship under construction and complain that they had been gassed. Several tests were made, but no gas could be found. The universal complaint was one of sudden dizziness when coming out of the compartments into the outside. Another complaint was of shortness of breath. A number of tests were made in conjunction with the Los Angeles city health department, but no gas could be found. It dawned on us finally that possibly there was a deficiency of oxygen, as this complaint always came from locations where considerable welding and burning was being conducted. More air was introduced and the complaints stopped. The action that was taking place was similar to a man taking about 10 fast, deep breaths. At no time was there any injury caused by the oxygen deficiency, but it did cause a mild form of excitement and could have been dangerous in that when a man became dizzy he might fall.

"OPEN FOR DISCUSSION"

Communications to the Editor

PRACTICAL POINTERS ON TEMPERATURE CONTROL

THE EDITOR—

Mr. Goodman's article in the November HPAC, giving practical pointers on automatic temperature control which he has gathered from his wide experience in heating and cooling work, is extremely timely and interesting. His thoughts are of unusual importance.

The problems involved in applying low limit thermostats are very completely set forth. It is certainly true that the air distribution equipment available today, and the increased knowledge of its use, permits the installation of satisfactory systems without low limit thermostats. Those manufacturing and engineering organizations who install such systems are certainly to be commended. However, we do find a surprising percentage of jobs on which unsatisfactory operation is obtained unless a low limit thermostat is allowed to be operative during seven to nine months of the year.

Of course, if heat is available during the entire 12 months of the year, it is usually necessary to make the low limit thermostat inoperative during the cooling season.

It is to be hoped that more and more jobs will be so well designed and installed that draftless distribution of air at any reasonable temperature is possible. This would entirely obviate the necessity for the low limit thermostat.

Mr. Goodman's point regarding the use of multiple thermostats is of tremendous importance. It is a practical impossibility to adjust two separate commercial thermostats to maintain a small difference in operating point over a long period of time.

To overcome this difficulty and to make it possible for an untrained person to readjust the control point as required, control manufacturers have made available two and even three stage thermostats so that two or three pieces of equipment may be properly controlled in sequence as temperature changes. These thermostats should always be used in preference to separate thermostats performing the same functions.

Control of the fan in a warm air heating system in such a manner that occupants of the heated spaces will not be conscious of the fan operation is a real problem. As Mr. Goodman points out, anything which will serve to maintain circulation without overheating the spaces helps reduce this consciousness of fan operation.

In many installations, if the fan continues to operate at high speed after the thermostat is satisfied, overheating will occur. The two speed operation is an excellent solution for this problem and would undoubtedly be more widely adopted if it were not for the expense of two speed motors. An alternate which has been found fairly satisfactory is to use a single speed fan and a damper arrangement to throttle the air after the thermostats are satisfied to such a value as to correspond to reduced fan speed operation. There is, of course, some saving in fan power due to the throttled air condition, but perhaps not quite as great as if the fan speed were changed.

Another alternate which is particularly useful on converted gravity jobs is the use of check dampers to prevent back flow while the fan is operating, and yet to permit gravity circulation while the fan is not operating. This system is almost always satisfactory where only a single floor is heated, but where two or more floors are heated at different levels, there is some danger that during the gravity circulation period the upper floors will overheat. This requires greater care in adjusting air flow than is usually employed.

As Mr. Goodman states, it is very difficult to make recommendations which can always be followed as infallible guides. However, it is hoped that these comments and suggestions may also be useful.—A. B. NEWTON, manager, refrigeration controls div., Minneapolis-Honeywell Regulator Co.

SCHEDULE NUMBER SYSTEM FOR PIPE SUPPLANTS OLD "STANDARD WEIGHT" AND "EXTRA STRONG" DESIGNATIONS

Sabin Crocker Describes Reason and Basis for Pipe Schedule Numbers and Recommends Using Them in Place of the Misnomers Formerly Employed in Piping Trade

SUMMARY — Although the schedule number system for pipe has been available for some time in standards of the American Standards Association and the American Society for Testing Materials, there are many piping engineers, contractors, and others who are not as yet familiar with the method and therefore do not use it. Mr. Crocker (secretary of ASA sectional committee B36 on standardization of dimensions and material of wrought iron and wrought steel pipe and tubing; senior engineer, engineering div., The Detroit Edison Co.; and member of HPAC's board of consulting & contributing editors) explains here the reason for and advantages of the schedule numbers, and tells why and how they should be used. . . . The American Standards Association is a federation of organizations by means of which standardization groups coordinate their efforts and make them effective; it is the principal standardization body in American industry. The American Society for Testing Materials has—since 1898—developed and promoted knowledge of the materials of engineering and has standardized specifications and testing methods

CONSIDERABLE INERTIA is encountered in supplementing the old misnomers "standard weight" pipe and "extra strong" pipe from everyday usage in the trade. These terms are a carryover from the horse and buggy era when any steam pressure less than 125 psi gage was accommodated by "standard" pipe and cast iron fittings and any steam pressure between 125 and 250 psi gage was suited by "extra strong" pipe and "extra heavy" cast iron fittings. There just weren't any cast steel or forged steel fittings or flanges in those days and no steam pressures higher than 250 psi. When cast steel flanges, fittings, and valves did enter the picture, they were made at first from the already existing 250 psi cast iron patterns and were generally rated as good for 300 psi steam pressure. About the same time, seamless steel pipe began to supplant furnace welded wrought iron or steel pipe for the more severe service conditions.

Shortly following the last war, steam pressures skyrocketed far beyond the 200 psi or so which had been tops for many years before, and service conditions in the oil industry jumped to unprecedented heights to suit new refining processes. Hence in addition to the then existing "strengths" and "weights," a whole series of new standards had to be set up for flanges, valves and fittings, and for pipe as well. Thus the American standard (ASA B16e) for steel pipe flanges and flanged fittings came into existence and later was extended to provide for seven steps of progressively higher steam pressures, viz, 150, 300, 400, 600, 900, 1500, and 2500 psi gage as rated at the basic temperature of 750 F. Equivalent ratings were established for the same products when used in oil service.

Need for New Pipe Schedules

Owing to the ensuing demand for pipe standards to match the various steps of the flange and fittings standards, ASA sectional committee B36 came into being and evolved the "schedule number" system for pipe having 10 steps and incorporating, in so far as practicable, the existing pipe weights in common use. The dimensions of welded and seamless steel pipe for the 10 schedules are shown in Table 1, which is reproduced from American standard ASA B36.10-1939. Attention is called to the thicknesses shown in bold face type in schedules 30 and 40, which are identical with thicknesses for "standard weight" pipe in former lists, and those in schedules 60 and 80, which are identical with thicknesses of the old "extra strong" pipe. Unfortunately the "double extra strong" thicknesses are too erratic to fit in with any schedule system where the allowable pressure has to be uniform throughout the size range. Except for the largest size (8 in.) "double extra strong" pipe is considerably heavier than schedule 160, the overthickness being more pronounced in the smaller sizes.

As stated from time to time on behalf of sectional committee B36 [see Heating, Piping & Air Conditioning for October and November, 1936, Use of American Standard Pipe Thickness Schedules, by Arthur McCutchan; also October, 1938, Use the New American Pipe Standard, by H. H. Morgan and Sabin Crocker], it is not the intent to rule out special thicknesses where the quantity of pipe desired warrants a special rolling at the mill, but rather to set up standard schedules to facilitate purchase of smaller lots of pipe. The purpose of the schedule number system has been to establish thicknesses throughout the size range of any schedule so as uniformly to suit the same service conditions and be reasonably consistent with the usual "basis of design" formulas. From commercial considerations and in an effort to save existing mill equipment, the committee has tried at the same time to fit *commonly used* thicknesses into the schedule number system insofar as possible. On the other hand, the committee hopes that the variety of thicknesses afforded by 10 schedules will suffice for more purposes so that *little used* thicknesses will not have to be stocked even though mill equipment for their manufacture does exist.

Schedule Numbers Explained

The schedule numbers, as explained in the standard (ASA B36.10-1939), serve as a key to the allowable working pressure for pipe of the thicknesses shown in the respective columns. This relation is derived from the expression:

Schedule Number $= 1000 \times P/S$ where P = internal pressure, psi; and S = allowable fiber stress, psi.

Thus, schedule 40 is roughly suitable for a service pressure of 400 psi up to 600 F, assuming an average value of allowable stress of 10,000 psi for grade A seamless pipe. In other words, for grade A seamless pipe, multiply the schedule number by 10 in order to approximate the maximum allowable working pressure.

Basic Formula.—In the course of its work, sectional committee B36 developed a basic formula for its own guidance in setting up theoretical nominal wall thicknesses for a wide range of pressure-stress ratios. This formula is not to be used for design and was released by the committee merely by way of explaining how the scheduled wall thicknesses were derived.

$$t = \left(\frac{P}{S} \times \frac{D}{1.75} \right) + 0.1$$

where P and S are as defined before; D = outside diameter of pipe, in.; and t = *nominal* wall thickness, in.

The foregoing is a modification of the Barlow formula for pipe wall thickness with a constant addition of 0.1 in. to compensate for threading and corrosion, and with the Barlow formula constant of 2 reduced to 1.75 to allow for a possible 12½ per cent manufacturing tolerance below *nominal* thickness.

Through computing the proper wall thickness for each nominal size of a given schedule by formula rather than trusting to the haphazard selection embodied in the "standard weight" and "extra strong" tables, it became possible to reclassify the existing weights into a more uniform system. The basic formula merely served for computing a rational set of thickness schedules, each of which comes somewhere near fitting a given set of service conditions throughout the full range of diameters embraced in the schedule.

Commercial Thicknesses Retained—After theoretical thicknesses were computed by formula, corresponding tabular thicknesses were selected for which mill equipment already existed, taking in each case the available thickness next greater than the theoretical. Fortunately (from a commercial viewpoint), it was possible to utilize nearly all of the well established "standard weight" and "extra strong" thicknesses in the reclassification as shown by bold face type in Table 1. Retention of these existing thicknesses had great commercial significance owing to the economic

Table 1—Dimensions of American standard welded and seamless steel pipe, ASA B36.10-1939

Nominal Pipe Size	Out-side Diam	Nominal Wall Thicknesses for Schedule Numbers									
		Sched 10	Sched 20	Sched 30	Sched 40	Sched 60	Sched 80	Sched 100	Sched 120	Sched 140	Sched 160
⅛	0.405	...	...	...	**0.068**	...	**0.095**	...	...	...	...
¼	0.540	...	...	...	**0.088**	...	**0.119**	...	...	...	...
⅜	0.675	...	...	...	**0.091**	...	**0.126**	...	...	...	...
½	0.840	...	...	...	**0.109**	...	**0.147**	...	...	...	0.187
¾	1.050	...	...	...	**0.113**	...	**0.154**	...	...	...	0.218
1	1.315	...	...	...	**0.133**	...	**0.179**	...	...	...	0.250
1¼	1.660	...	...	...	**0.140**	...	**0.191**	...	...	...	0.250
1½	1.900	...	...	...	**0.145**	...	**0.200**	...	...	...	0.281
2	2.375	...	...	...	**0.154**	...	**0.218**	...	...	...	0.343
2½	2.875	...	...	...	**0.203**	...	**0.276**	...	...	...	0.375
3	3.5	...	...	...	**0.216**	...	**0.300**	...	...	...	0.437
3½	4.0	...	...	...	**0.226**	...	**0.318**	...	...	...	...
4	4.5	...	...	...	**0.237**	...	**0.337**	...	0.437	...	0.531
5	5.563	...	...	...	**0.258**	...	**0.375**	...	0.500	...	0.625
6	6.625	...	...	...	**0.280**	...	**0.432**	...	0.562	...	0.718
8	8.625	...	0.250	**0.277**	**0.322**	0.406	**0.500**	0.593	0.718	0.812	0.906
10	10.75	...	0.250	**0.307**	**0.365**	**0.500**	0.593	0.718	0.843	1.000	1.125
12*	12.75	...	0.250	**0.330**	0.406*	0.562*	0.687	0.843	1.000	1.125	1.312
14 O.D.	14.0	0.250	0.312	0.375	0.437	0.593	0.750	0.937	1.062	1.250	1.406
16 O.D.	16.0	0.250	0.312	0.375	0.500	0.656	0.843	1.031	1.218	1.437	1.562
18 O.D.	18.0	0.250	0.312	0.437	0.562	0.718	0.937	1.156	1.343	1.562	1.750
20 O.D.	20.0	0.250	0.375	0.500	0.593	0.812	1.031	1.250	1.500	1.750	1.937
24 O.D.	24.0	0.250	0.375	0.562	0.687	0.937	1.218	1.500	1.750	2.062	2.312
30 O.D.	30.0	0.312	0.500	0.625	...	...	...	...	...	...	...

All dimensions are given in inches.

The decimal thicknesses listed for the respective pipe sizes represent their nominal or average wall dimensions. For tolerances on wall thickness, see appropriate material specification.

Thicknesses shown in bold face type in schedules 30 and 40 are identical with thicknesses for "standard weight" pipe in former lists; those in schedule 60 and 80 are identical with thicknesses for "extra strong" pipe in former lists.

The schedule numbers indicate approximate values of the expression $1000 \times P/S$.

*Owing to a necessary departure from the old "standard weight" and "extra strong" thicknesses in the 12 in. size, schedules 40 and 60, the new thicknesses are not as yet stocked by all manufacturers and jobbers. Hence, where agreeable to the purchaser and suitable for the service conditions, the old "standard weight" 0.375 in. wall pipe corresponding to a 1000 P/S value of 37.7 is still available and can be substituted for the 0.406 in. wall, and tne old "extra strong" 0.500 in. wall pipe corresponding to a 1000 P/S value of 55 can be substituted for the 0.562 in. wall.

waste which would have resulted from scrapping existing mill equipment for a wholly fresh start.

Code Formulas

As stated in the standard, it is contemplated that the proper thickness of pipe will be selected through two simple steps. First, the theoretical *minimum* thickness for the conditions for which the pipe is required should be computed using an appropriate design formula from the ASME boiler code, the American standard code for pressure piping, or a similar code. Then, if the pipe is to be ordered to *nominal* wall thickness as is customary in trade practice, the manufacturing tolerance on wall thickness must be added to the *minimum* thickness determined by code formula. The next heavier commercial wall thickness may then be selected from the schedules of the B36 standard, bearing in mind any special rules, such as the requirement that no pipe lighter than schedule 40 ("standard weight") shall be threaded, and that the value of P in formula 1 shall not be taken at less than 100 psi gage for any conditions or material.

In order to avoid the appearance of complexity, it should be emphasized that schedule 40 ("standard weight") pipe will suffice for most low pressure services where screwed joints are used and that computation of wall thickness by formula usually is unnecessary under such circumstances. With welded joints, or other joints or couplings where the pipe ends are not weakened by threading, it may be feasible to use schedule 20 or even lighter pipe in sizes 8 in. and larger where the service conditions are not too severe. Under these conditions, as well as where high pressures are involved, it usually is desirable to compute by formula the required thickness of pipe for the expected material, type of joint, and service conditions. By way of illustrating how to go about selecting the proper pipe wall thickness by formula, the following typical examples have been worked out according to rules condensed below from paragraph 122(a) of the 1942 revision of the American standard code for pressure piping:

"*122. Thickness of Pipe:* (a) For inspection purposes the minimum thickness of pipe wall required at different pressures and for temperatures not exceeding those for the various materials shown in (d) of this paragraph, shall be determined by Formula 1 as follows:

$$t_m = \frac{PD}{2S} + C \ldots\ldots\ldots\ldots [1]$$

where t_m = minimum pipe wall thickness, in.
P = maximum internal service pressure, psi gage;
D = outside diameter of pipe, in.;
S = allowable stress in material due to internal pressure at the operating temperature, psi, (from Table 3 of code); and
C = allowance for threading, mechanical strength, and/or corrosion, in in."

Example 1, 100 Psi Gage Steam, Threaded Ends—What nominal wall thickness will be required for a 10 in. nominal size pipe carrying saturated steam at 100 psi gage? Lap welded pipe, ASTM A120, will be used and the pipe ends will be threaded for screwed companion flanges.

Solution—P = 100 psi gage; D = 10.75 in. from any pipe table; S = 8000 psi from piping code; C = 0.100 in. for threaded end pipe from piping code; hence

$$t_m = \frac{100 \times 10.75}{2 \times 8000} + 0.100$$
$$= 0.0672 + 0.100 = 0.1672 \text{ in.}$$

Since commercial usage as well as the manufacturing tolerance of A120 permit a minimum thickness on inspection of 12½ per cent under the nominal thickness, the computed value for t_m represents only 87½ per cent of the theoretical nominal thickness required. Hence the theoretical nominal thickness t_n is found as follows:

$$t_n = t_m/0.875$$
$$= 0.1672/0.875 = 0.191 \text{ in.}$$

Referring to Table 1, the 0.365 in. wall of schedule 40 (corresponding to "standard weight" in this size) is selected as the lightest commercial thickness which can be used with threaded ends (nothing lighter than schedule 40 can be threaded).

Example 2, 100 Psi Gage Steam, Welded Ends—What nominal wall thickness will be required for a 10 in. nominal size pipe carrying saturated steam at 100 psi gage? Electric resistance welded pipe, ASTM A135, grade A, will be used and the joints will be fusion welded according to code requirements.

Solution—P = 100 psi gage; D = 10.75 in. from any pipe table; S = 9400 psi from piping code; C = 0.065 in. for plain end pipe from piping code; hence

$$t_m = \frac{100 \times 10.75}{2 \times 9400} + 0.065$$
$$= 0.058 + 0.065 = 0.123 \text{ in.}$$

Since commercial usage as well as the manufacturing tolerances of A135 permit a minimum thickness on inspection of 12½ per cent under the nominal thickness, the computed value for t_m represents only 87½ per cent of the theoretical nominal thickness required. Hence the theoretical nominal thickness t_n is found as follows:

$$t_n = t_m/0.875$$
$$= 0.123/0.875 = 0.141 \text{ in.}$$

Referring to Table 1, the 0.250 in. wall of schedule 20 is selected as the commercial thickness next heavier than the theoretical nominal thickness of 0.141 in. While this is considerably heavier than necessary, it still is a decided saving over using "standard weight" (schedule 40) pipe 0.365 in. thick, which would have been dictated under old rule of thumb methods and the use of threaded pipe.

Incidentally, this illustration serves also to point the need for offering a more generous selection of wall thickness in jobber's stocks if full savings are to be realized through the use of welded joints. Under conditions heretofore obtaining, the lack of anything lighter than "standard weight" pipe in jobber's stock probably would preclude being able to get walls thinner than 0.365 in., or at best 0.307 in., for the 10 in. size under discussion. A similar situation obtains with other sizes. This condition is not conducive to preventing wastage of steel tonnage in either peacetime or wartime.

Trade Acceptance of Schedule Numbers

For severe service conditions such as those obtaining in power plants, oil refineries, cross-country natural gas lines, and the like, where computation of pipe wall thickness by code formula is an economic necessity, adoption of the schedule number system in everyday usage was a foregone conclusion. During the seven years since the ASA B36.10 tables were first published as a tentative American standard, the users of pipe for such services, together with the mill men and jobbers supplying it, have become familiar with the new designations and have incorporated them in their trade vocabulary. Accordingly, the existence of Table 1 is generally recognized in the high-grade pipe trade and such pipe is customarily ordered according to schedule number. Although the severity of the service conditions in these industries is responsible for a great deal of thought being devoted to the proper selection of pipe, nevertheless — when considered on a volume of trade basis— their percentage of the total pipe business is relatively small. Hence there still remains a considerable majority of the pipe trade concerned with pipe for ordinary uses which is as yet unfamiliar with the new terminology.

In the heating trade, and for other low pressure service where the wall thickness of pipe is determined by trade usage, scant attention is given to computing thickness by code formula. Here the old terms "standard weight," "extra strong," and "double extra strong" remain so firmly entrenched that it is difficult to supplant them irrespective of how illogical their continued use may be under present conditions. Moreover, many people who could be using the new system to advantage have never even heard of it and are not aware of its existence. Hence it has been impracticable, thus far, to set a definite date for a complete change over to the new schedule numbers.

As an initial step in furthering the use of schedule numbers the ASA B36.10 table (Table 1 of this article) has been incorporated in, or appended to, a number of specifications of the American Society for Testing Materials including ASTM A53, A106, A120, A135, A158, and A206. Up to and including the year 1940, the old versions of the tables for "standard weight," "extra strong," and "double extra strong" pipe were retained as well in A53 and A120 owing to the general use of these specifications by the heating trade.

The original thought in this matter was that the presence of both tables in A53 and A120 would soon familiarize the trade with the significance of schedule numbers so that the old terminology and tables could be dropped in the course of a few years. Response was slow, however, and it became evident that some intermediate step was needed to facilitate the changeover. Accordingly, the combined table shown here as Table 2 was designed for use in specifications A53 and A120 to supplant the old table of "standard weights and dimensions of welded and seamless steel pipe."

Through the use of Table 2 it is hoped to better acquaint the trade with the existence of the new system and to familiarize everyone concerned with the relation of the old and the new. If this conception takes hold it may be possible eventually to supplant the old misnomers, which have clung so tenaciously in trade usage, with the new schedule numbers more in keeping with present conditions. This article has been prepared with a view to furthering greater use of the standard through bringing it to the notice of more people connected with the piping trade.

Further cooperation in switching to schedule numbers has been accorded by the welding fitting manufacturers in agreeing to use this system of designation for their product made in conformance with the American standard for steel butt welding fittings, ASA B16.9-1940, from which the following is quoted:

> "*Metal Thickness:* As these fittings are to match pipe their strength and the dimensions at the welding ends must conform with established pipe standards. Nominal end dimensions other than for castings shall comply with the ASA pipe schedules as given in B36.10 (see Appendix) on such sizes as are available."

As time goes on it is hoped that other products associated with pipe will fall into line so that full acceptance of schedule number designations for pipe will be inevitable.

Table 2—Standard weights and dimensions of welded and seamless steel pipe. (from ASTM specifications A53-42 and A120-42).

Note 1—Where more than one weight is listed under the same size and class, the order should definitely specify the wall thickness desired.

Size (Nominal Inside Diameter), in.	Outside Diameter, in.	Number of Threads per Inch	"Standard Weight" Pipe				"Extra Strong" Pipe				"Double Extra"[b] Strong pipe	
			Schedule 30		Schedule 40		Schedule 60		Schedule 80			
			Thickness, in.	Weight of Pipe per Linear Foot, Threaded and with Couplings, lb.	Thickness, in.	Weight of Pipe per Linear Foot, Threaded and with Couplings, lb.	Thickness, in.	Weight of Pipe per Linear Foot, Plain Ends, lb.	Thickness, in.	Weight of Pipe per Linear Foot, Plain Ends, lb.	Thickness, in.	Weight of Pipe per Linear Foot, Plain Ends, lb.
⅛	0.405	27	....	....	0.068	0.25	....	....	0.095	0.31	....	....
¼	0.540	18	....	....	0.088	0.43	....	....	0.119	0.54	....	....
⅜	0.675	18	....	....	0.091	0.57	....	....	0.126	0.74	....	....
½	0.840	14	....	....	0.109	0.85	....	....	0.147	1.09	0.294	1.71
¾	1.050	14	....	....	0.113	1.13	....	....	0.154	1.47	0.308	2.44
1	1.315	11½	....	....	0.133	1.68	....	....	0.179	2.17	0.358	3.66
1¼	1.660	11½	....	....	0.140	2.28	....	....	0.191	3.00	0.382	5.21
1½	1.900	11½	....	....	0.145	2.73	....	....	0.200	3.63	0.400	6.41
2	2.375	11½	....	....	0.154	3.68	....	....	0.218	5.02	0.436	9.03
2½	2.875	8	....	....	0.203	5.82	....	....	0.276	7.66	0.552	13.70
3	3.500	8	....	....	0.216	7.62	....	....	0.300	10.25	0.600	18.58
3½	4.000	8	....	....	0.226	9.20	....	....	0.318	12.51	0.636	22.85
4	4.500	8	....	....	0.237	10.89	....	....	0.337	14.98	0.674	27.54
5	5.563	8	....	....	0.258	14.81	....	....	0.375	20.78	0.750	38.55
6	6.625	8	....	....	0.280	19.19	....	....	0.432	28.57	0.864	53.16
8	8.625	8	0.277	25.00	0.322	28.81	....	....	0.500	43.39	0.875	72.42
*10	10.750	8	0.307	35.00	0.365	41.13	0.500	54.74	....	....	....	....
**12	12.750	8	0.330	45.00	**0.375	50.71	**0.500	65.41	....	....	....	....

(a) Sizes larger than those shown in the table are measured by their outside diameter, such as 14 in. in outside diameter, 16 in. outside diameter, etc.

These larger sizes will be furnished with plain ends, unless otherwise specified.

The weights will correspond to the manufacturers' published standards although it is possible to calculate the theoretical weights for any given size and wall thickness on the basis of 1 cu in. of steel weighing 0.2833 lb.

(b) The American standard for wrought iron and wrought steel pipe (ASA B36.10-1939) has assigned no schedule number to "double extra strong" pipe.

*Standard weight pipe 10 in. in nominal size is also available with 0.279 in. wall thickness, but this wall is not covered by a schedule number.

**Owing to a departure from the "standard weight" and "extra strong" wall thicknesses for the 12 in. nominal size, schedules 40 and 60, in Table 2 of the American standard for wrought iron and wrought steel pipe (ASA B36.10-1939) the regular "standard" and "extra strong" wall thicknesses (0.375 in. and 0.500 in.) have been substituted.

REMEMBER
PEARL HARBOR!
BUY
WAR BONDS

WAR PROBLEMS FORUM

SCHOOL CHILDREN TEACH US A THING OR TWO ABOUT SALVAGE

CITIZENS OF the United States are made to realize by what is seen and heard every day that they must conserve, that they must save, that they must make the best with what they have, and the most of what they have. To an engineer, conservation means efficiency, which to his mind has been understood to be the relation between the input and the output measured in useful results. It has now taken a turn that leads to the exercise of ingenuity in applying materials to new uses, in finding substitutes both for materials and methods that can no longer be used, and exercising a concern over the care of equipment and supplies that once gone cannot now be replaced.

In too many things people do not carry an action completely through. For example, we are told to conserve fuel. Few people realize that when we conserve fuel we are not only saving fuel itself at the point of consumption but we are saving labor and equipment in its production, labor and equipment in its transportation, and labor and equipment in its distribution. This is true of practically everything we use, for in almost every article that goes into our daily living, labor, supplies, and equipment went into the manufacture of it—and by the amount we save through conservation and careful use we add to the assets available for our national war effort.

Scrap metal is a critical material that must be saved through salvaging. Scrap metal may be defined as any metal found in equipment or supplies that are not now being used and that will not be used by anyone for some time. Equipment long idle —that is, no longer of use—may be termed scrap just as are the broken fragments of the casting in the junk pile.

In salvaging scrap metals we make available a stock of scrap so necessary at our steel mills and make a pool of material available that is already close to the point where it is needed. The ore for our mills requires great expenditures of labor and equipment to dig it from the ground and transport it hundreds of miles to the steel furnaces. The metal scrap requires much less expenditure in labor and in transportation equipment to get it from the scrap heaps to the mills.

Scrap Metal from Schools

When the need for salvaging of scrap metal was first stressed, the bureau of engineering of the Chicago Board of Education made a survey of each of its 400 school plants to determine what scrap metal about the plants—such as old grate bars or broken machine castings—could be released to help make up the scrap metal shortage at the mills. The first effort resulted in the salvaging of about 1500 lb of cast iron scrap per school, a total of 600,000 lb from all plants. When the need for further effort became more apparent later, it was decided to organize the pupils in the neighborhood metal salvage drive. Salvage depots were established at every school, prizes were offered for the greatest amount of salvage metals collected (based on a per pupil collection), with contests between rooms and between schools. The money received from the sale of the scrap went to the school itself, the student council of the school in every instance deciding how it should be spent. Practically all voted to donate the money to some charity, most of them voting to turn it in to the children's aid thanksgiving fund. The interest was keen, the pupils entered into the spirit of the program in an enthusiastic manner, and a great variety of articles—from bed springs to boiler parts—appeared on the school scrap piles. The weight of scrap iron salvaged in this drive totaled 6,000,000 lb, illustrating how many little things together add up to a large total.

The scrap metal drive in the schools was followed by a drive for flat keys, valued because they contained a nickel alloy. A total of 10,000 lb of such keys—approximately 400,000 keys—was brought to our schools by pupils within one week. The "junior commandos" have made a definite contribution to our war effort and have put to shame some of the mature, more aged, ultraconservatives who seem ever ready with the question "Why?" rather than with the question "Why not?"—JOHN HOWATT, chief engineer, Chicago Board of Education, and member of HPAC's board of consulting & contributing editors.

WPB ANNOUNCES NEW WAR HOUSING CONSTRUCTION RULES

BUILDERS THE country over will be required to gear all future housing construction to the war program by meeting standards of design and material consumption which were announced last month by the WPB director general for operations under the title, War Housing Construction Standards. The purpose of the directive is to insure that maximum amounts of housing for essential wartime needs will be provided from limited visible supplies of critical materials, particularly metals and softwood lumber.

Large and small housing projects are affected alike by the standardization of design and materials. Builders whose plans and specifications fail to conform to the war housing standards will be denied priority assistance. All housing projects of whatever kind must comply with the standardized requirements in order to qualify for preference ratings.

Permissible installations of heating units are specified for the various types of dwellings, to insure that the capacity of the heating plant will not exceed the actual requirement. According to the standards, heating plants shall not exceed the following limits:

A. For one, one and one-half, and two story structures, consisting of single family detached, semi-detached, and row dwellings and multi-family flats or row type dwellings:

(1) Where heat loss of dwelling unit is less than 40,000 Btu, one of the following units may be used:

(a) One floor furnace per dwelling unit.
(b) One pipeless furnace per dwelling unit.
(c) One space heater per dwelling unit.
(d) One chimney heater range.

(2) Where heat loss of dwelling unit in one story structures is 40,000 Btu or more, and for any heat loss permitted by the Housing Critical List in two story structures, one of the following units may be used:

(a) One gravity distribution furnace per dwelling unit.
(b) One space heater per dwelling unit.
(c) One chimney heater range per dwelling unit.
(d) One chimney furnace or other forced circulation warm air furnace per dwelling unit in basementless, one story, three bedroom dwelling units and in any basementless two story structure.
(e) One floor furnace per dwelling unit. Additional floor furnace may be authorized, if necessary, but not in excess of the heat loss limitations established by the War Housing Critical List.

B. For one and two story structures, excluding two story row type dwelling units, where each heating system serves four or more dwelling units, and where less than 25 per cent of the dwelling units in such structures are lower than two stories, one of the following units may be used:

One pipe steam or one pipe forced hot water system with radiators provided that the weight of the system shall not exceed the weight determined by the following formula allowing the heat loss of 66 Btu per sq ft of dwelling area:

Net Btu Loss of Structure:	Pounds of Metal per 1000 Btu
Up to 175,000	37
175,000 to 250,000	36
250,000 to 350,000	35
350,000 to 500,000	34
500,000 to 700,000	33
Over 700,000	32

C. For dormitory type apartment structures:

(1) Forced circulation warm air furnace system.

(2) One pipe steam or one pipe forced hot water system with radiators.

D. For dormitory structures:

(1) Forced circulation warm air furnace system.

ECONOMICAL OPERATION OF HEATING SYSTEMS

SUGGESTIONS FOR the economical operation of heating systems in post offices were issued some three years ago by the maintenance branch of the division of building operations and supplies of the Post Office Department. The current importance of fuel conservation to aid the war effort makes them of interest to engineers responsible for the heating of all types of buildings. The suggestions follow:

1) Since the amount of fuel used depends on the temperature difference between the inside and outside of a building, any increase in the inside temperature above that actually required will result in waste of fuel. Should the inside temperature become so high as to cause occupants to open windows for relief, the waste increases very rapidly. Care should be taken, therefore, to see that correct temperatures are maintained and particularly that occupants do not find it necessary to open windows to cool their rooms.

2) Do not heat storage space to the temperature required in occupied sections. Shut heat off entirely in unoccupied space, taking care to avoid freezing of plumbing.

3) In buildings equipped with ventilating apparatus, avoid unnecessary ventilation. The equipment is designed to meet extreme conditions of weather and occupancy. Ventilation sufficient for 500 employees should not be supplied when only 50 are present. Over-ventilation is very costly.

4) For vacuum systems, maintain a high vacuum, or if this is not possible, locate and eliminate all leaks. A high vacuum will insure rapid response when steam is turned on. Correct sluggish circulation.

5) For buildings using purchased steam, shut steam off whenever possible during the night, Sundays, and holidays. Unless the system is thermostatically controlled, steam should also be shut off for intervals during the day whenever possible, particularly in moderate weather. Heating systems are designed to meet the lowest temperature which will be encountered, with the result that on moderate days there will be a tendency to overheat unless close attention is given.

6) If thermostatic controls, either of the zone type or individual room or radiator type, are provided, make frequent checks to determine whether proper temperatures are actually being maintained. Such controls are often classed as fully automatic but our experience indicates that careful supervision must be given to obtain the maximum economy. This is especially true during the warmer months of the heating season, for the reason that the controls have a tendency to overshoot and cause temperatures higher than necessary.

7) For buildings heated with their own plants, fires should be carried in accordance with outside temperatures and should be kept as low as possible, or banked, during the night, Sundays, and holidays. If the piping permits, steam should be shut off at night from sections of the building, such as office sections occupied only 8 to 10 hr per day, care being taken to prevent freezing of plumbing.

8) For stoker fired plants, use

as little forced draft as possible. To use more draft than necessary will result in high stack losses and often in the production of excessive fly ash.

9) With hand fired plants burning coal, use the stack damper when banking fires or when checking the plant rather than by closing the ashpit doors only. With the ashpit doors shut and the stack damper open, the "draw" of the stack will pull air through leaks in the setting and around the doors, cooling the boiler unnecessarily.

10) Where more than one boiler is provided, do not operate more than enough to carry the load.

11) Personnel in charge of gas fired plants should watch the adjustment of the burners and dampers closely to obtain efficient combustion. The suggestions already given relative to carrying correct temperatures and shutting off the heat whenever possible are also applicable to gas fired plants.

The foregoing suggestions have been found to be very useful at the majority of buildings and they are to be given careful attention. In addition, other means of economizing applicable only to individual buildings can usually be found. Personnel in charge of plants should thoroughly understand their plants and make every effort to reduce the consumption of fuel.

IMPROVISED AFTERCOOLERS FOR COMPRESSED AIR

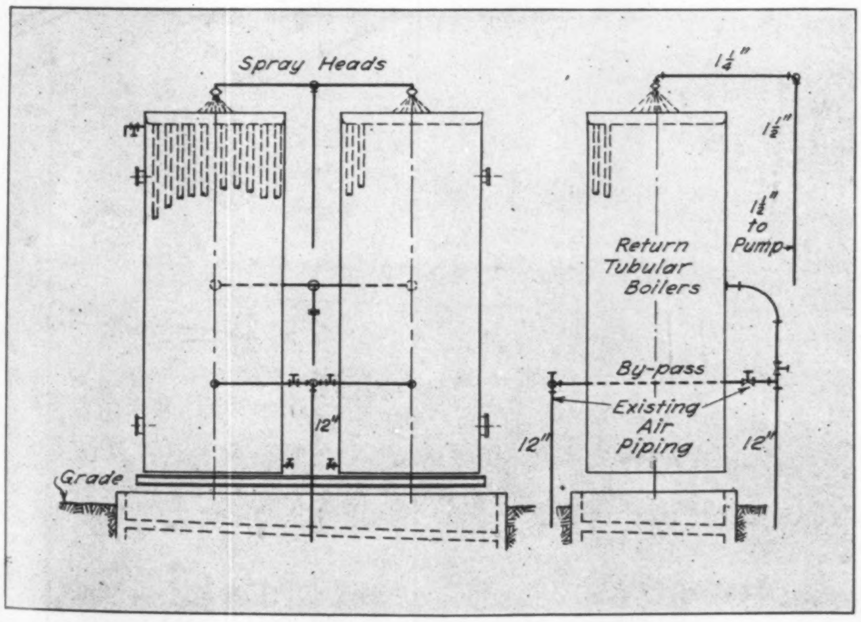
LARGE SCALE expansion of an eastern war plant required a big increase in the compressed air facilities. Two 2900 cfm air compressors were added to the existing 2200 cfm machine, all supplying air at 100 psi pressure. While these machines are equipped with intercoolers, no aftercoolers were installed, and trouble was experienced from water and oil in the distribution piping, which extends about a mile through the plant buildings.

Delivery of the required aftercoolers for the job would have been slow and the cost seemed high. However, there were on hand several used return tubular boilers, 72 in. diameter by 16 ft long, which had the required surface to do the cooling.

Two of these boilers were set up as indicated in the sketch. A portion of the jacket cooling water discharge was piped to spray heads at the top. The concrete form under the boiler catches the water leaving the tubes and returns it to the drain.

These aftercoolers lower the temperature of the compressed air on the average from 175 F to 100 F, with an ambient temperature of 70 F. A considerable amount of water and oil is removed. The coolers are drained by air separator traps and may also be blown down manually.
—G. K. S.

When a war plant required increased compressed air facilities and the necessary aftercoolers weren't easily available, two used return tubular boilers were employed to do the job, as shown here.



COPPER TABOO FOR BUILDINGS

Installation of copper in buildings has been reduced to practically zero with the issuance of an amendment to supplementary conservation order M-9-c-4 by the WPB director general for operations.

The amendment continues to restrict the use of copper building products for repairs to 25 lb or less and permits these small amounts to be used only when they were in the possession of the user on October 27. The effect of the amendment is to prevent the purchase, sale, delivery, and use of any copper for installation in buildings so that stocks may be acquired by the government and remelted for war use.

The order previously restricted use of copper items to buildings alone. As amended, the order extends the prohibition on the use of most copper products to water systems outside buildings, installations in cooling towers, and water towers.

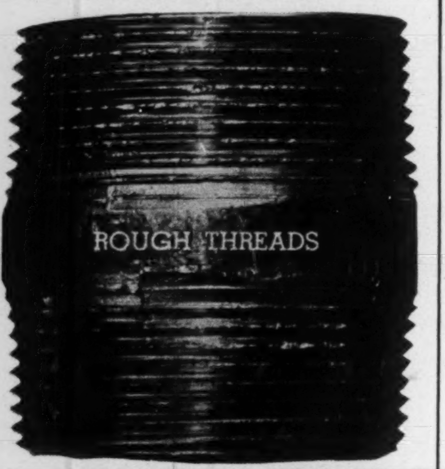
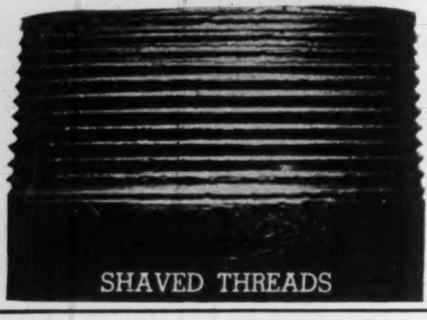
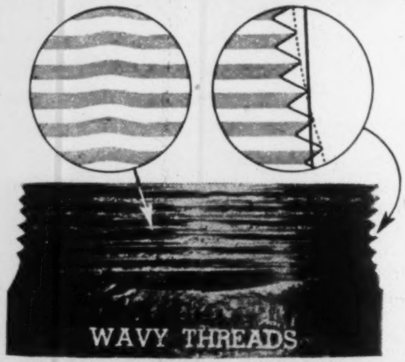
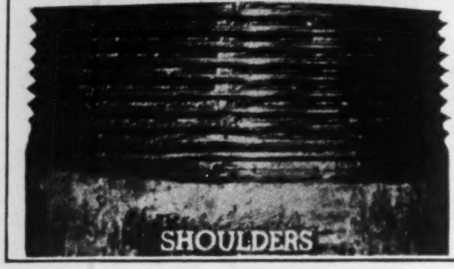
OPA RULES ON BURNER SERVICE RATES

Three conditions which an oil burner service company must meet before it may increase its rates over those of last winter were laid down October 28 by OPA. In an interpretation of the services regulation (maximum price regulation No. 165, as amended), OPA warned that charges for maintenance and repair service on oil burners may be raised only if all these tests are met.

1) The increase must have been effective before April 1, 1942, and work must have been done at the higher rate before that date.

2) The increase must have been a general increase applying at once to customers without contracts, and to other customers as rapidly as their contracts expired.

3) After the increase became effective, all work must have been billed at the higher rate, except only such work as was done under earlier contracts requiring lower rates.

WHEN THREADS LOOK LIKE THESE . . .	HAND THREADING	
	LOOK FOR . . .	CURES . . .
 ROUGH THREADS	DULL CHASERS (Check by inspection)	SHARPEN
	INSUFFICIENT LUBRICATION (This not only makes poor threads but damages chasers.)	USE PLENTY OF GOOD OIL (Sulfur base threading oil plus little lard oil gives good results.)
	IMPROPER LEAD SHAPE (Usually due to improper grinding.)	GRIND PROPERLY
	EXCESSIVE OR INSUFFICIENT LEAD CUTTING ANGLE	GRIND TO CORRECT ANGLE
	BROKEN TOOTH IN CHASER	GRIND OUT ENTIRE TOOTH
	CHASERS NOT SET TO FORM TRUE CUTTING CIRCLE	CLEAN SLOTS—SET CHASERS TO TRUE CUTTING CIRCLE —GRIND CHASERS TO MAKE THEM OF UNIFORM LENGTH
 SHAVED THREADS	IMPROPER LEAD OF CHASER	REGRIND LEAD
	CHASERS NOT TRACKING PROPERLY	KEEP SLOTS CLEAN
	CHASERS NOT SET IN DUE ROTATION	CORRECT SETTING
 WAVY THREADS	DIE OR CHASERS NOT SET TRUE	CENTER DIE OR CHASERS
	THUMB SCREWS NOT TIGHT	TIGHTEN SCREWS WITH WRENCH
	WORN-OUT LEAD SCREWS	GET NEW DIE STOCK
	CUTTINGS OR DIRT IN CHASER SLOTS	KEEP SLOTS ALWAYS CLEAN
 SHOULDERS	PIPE ENDS NOT SQUARE (Die starts on same angle as end cut, and threads diagonally. This trouble often wrongly blamed on "out-of-round" pipe.)	CUT PIPE END SQUARE TO AXIS OF PIPE AND RETHREAD

A "TROUBLE SHOOTER"—FOR CORRECTING PIPE THREADING ILLS

MACHINE THREADING	
LOOK FOR . . .	CURES . . .
DULL CHASERS	SHARPEN
INSUFFICIENT LUBRICATION	FLOOD WITH GOOD OIL (Sulfur base plus little lard oil gives good results.)
IMPROPER LEAD SHAPE	GRIND PROPERLY
IMPROPER LEAD CUTTING ANGLE	REGRIND TO PROPER ANGLE
BROKEN TOOTH IN CHASER	GRIND OUT ENTIRE TOOTH
CHASERS NOT SET TO FORM TRUE CUTTING CIRCLE	CORRECT SETTING
IMPROPER LEAD OF CHASER	REGRIND LEAD
CHASERS NOT TRACKING PROPERLY	KEEP SLOTS CLEAN
CHASERS NOT SET IN DUE ROTATION	CORRECT SETTING
CARRIAGE TRAVEL RETARDED	REPAIR CARRIAGE
LOOSE CHASERS (Play in slot lets chasers tilt, increasing clearance.)	NEW DIE HEAD
WORN CAM IN DIE HEAD (Check lost motion due to worn cam.)	NEW DIE HEAD
MISALIGNMENT OF DIE AND CHUCK	CHECK AND RE-ALIGN

DO'S AND DON'TS IN THREADING

Don't try to work with dull tools. No craftsman can do good work with poor equipment.

Don't put new or sharpened chasers in a worn stock, and expect to get first-class results. After the stock is worn out, it should be discarded.

Don't skimp on oil—either in quantity or quality. Good oil pays dividends in better work, and longer die life.

Don't try to use a set of chasers after long use or abuse has impaired its precision. Discarding worn out chasers is sound economy.

Don't forget to accurately center the die and tighten the thumb screws *WITH A WRENCH* in hand threading, and don't forget to line up the pipe properly in the grips in machine threading.

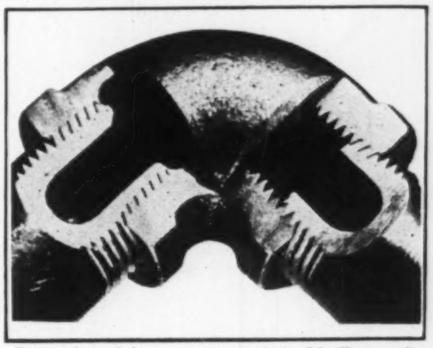
Be sure to clear slots of all dirt, gummy oil, chips, etc., when you change chasers. Keeping tools clean lengthens their life.

Be sure, when the chasers are reground, that it is done by someone who knows how, or who will accurately follow directions. Wrong grinding can ruin chasers, spoiling a multitude of threads.

Be sure that the pipe ends are cut off square and true. Give the die a fair chance, so it can start on straight.

When trouble occurs, *check up your equipment carefully*. It may be that the trouble is something that a little adjustment will fix. In any case, the difficulty can be corrected with a minimum of cost and lost time.

And finally, cut the thread long enough to engage fully the threads in the fitting. A thread like the one illustrated below, is too short to resist mechanical forces caused by expansion and contraction, vibration, and so forth.



Reproduced by courtesy of A. M. Byers Co.

Greater care and correct procedure in handling of all the materials used in heating, piping, and air conditioning work can be of considerable benefit to the war effort by speeding fabrication and installation and conserving our resources . . . The chart presented here is one of a series designed for use by contractors, pipefitters, industrial maintenance crews, shipyards, and others who work with wrought iron.

THE DRYING OF FOODS

War Creates Tremendous Demand for Dried Foods to Save Shipping and Storage Space, Prevent Spoilage . . . . . W. R. Marshall, Jr., Describes the Drying Fundamentals Involved

SUMMARY — The importance of food drying has predominated in times of war, present practice in the field having received its development and expansion during the Boer War and World War I. The great need for large supplies of concentrated foods for our armies and those of our allies—and our civilian allies—has created a tremendous demand for dried foods. . . . There is a big field for more engineering attention to food drying problems, and heating, air conditioning, and piping are all involved. For this reason, Heating, Piping & Air Conditioning presents in a group of articles—of which this is the fourth—a comprehensive and practical review of food drying today. A description of the general problem of food drying was given in Mr. Marshall's first article, published in the September HPAC. In October, he covered methods and equipment, and last month he gave data on the fundamentals of drying, which he continues here. . . . The author has specialized in the subject of drying, and is connected with the technical division of the engineering department at E. I. du Pont de Nemours & Co.

IT WAS shown in a previous article (5)* that the design of a dryer is directly dependent upon three items—a material balance, a heat balance, and the rate at which the material dries. The importance of the rate of drying was stressed, and the fundamental nature of the drying rate curve was briefly outlined.

It is now our purpose to analyze some typical data for the drying of foods to observe the nature of the drying time and drying rate curves for food drying. The data on which these curves are based were provided through the courtesy of the research department of Proctor and Schwartz, Inc. For obvious reasons, the actual values of drying times have been replaced by fictitious values. However, the true proportions between the drying times have been maintained for all curves to permit the comparison of drying schedules among the various types of foods.

Analysis of Drying Data for Foods

The two fundamental drying curves on pp. 672-673 of the November HPAC serve as excellent guides for analyzing a drying process in which solids are involved. These curves make it possible to tell what drying conditions are most likely to influence the drying rate. Thus, when a large portion of the time curve is linear it is to be concluded that air velocity, humidity, and temperature all influence the drying rate over a large percentage of the total drying time. The linear portion of the curve also serves to indicate the maximum rate of evaporation and hence can be used to calculate the maximum heat load to be expected. This information is important for the first stages of drying, when a dryer must handle a larger amount of steam or fuel than is required during the last stages.

In the accompanying graphs, representative drying curves are presented for potatoes, carrots, beets, and ground beef. The data for these curves were obtained by means of through-circulation drying in which air was blown through a layer of the food on a screen bottom tray. This kind of drying simulates drying on a continuous screen conveyor dryer of a type whose operation was described previously (4). One feature of its operation should again be noted, namely, the reloading process, whereby the layer of food is reloaded from a depth of 2 to 3 in. to a depth of anywhere from 6 to 18 in., depending upon the food being dried. This process was duplicated in all the tests reported here. In general, air is blown upward during the first stages of drying and downward at the end of the process. This, too, was duplicated in most tests.

Effect of Air Temperature and Humidity

In Fig. 1 are shown typical drying time curves for boiled riced potatoes dried under three different conditions of air temperature and humidity. The corresponding rate curves, obtained by graphical differentiation of these time curves, are shown in Fig. 2. It is important to note the distinct variations in the values of the constant rate, but the slight differences in the falling rate period. In general, the critical moisture content (that moisture content at which the falling rate begins) tends to increase as the constant rate increases. This has been found to be generally true for other materials, and it is explained on the basis that at high constant rates the ratio of the constant rate to the rate of movement of the internal moisture is larger than at lower constant rates, and hence the surface starts to dry out at a higher critical moisture content. A typical warming up period is apparent in each case.

Actually, the effect of air temperature cannot be determined without knowing the temperature of the material, since it is the temperature of the surface of the food which determines the drying rate. In the case of the data on riced potatoes it was assumed that the surface temperature during the constant rate period corresponded to the wet bulb temperature of the drying air. From this it was possible to determine the saturation

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*Numbers in parentheses refer to references at the end of this article.

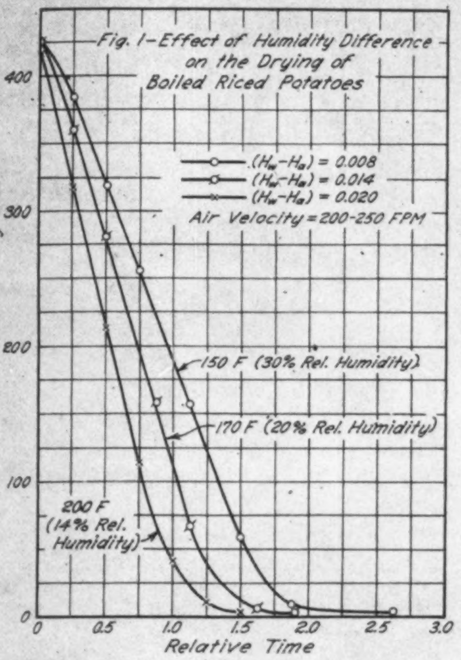


Fig. 1—Effect of Humidity Difference on the Drying of Boiled Riced Potatoes

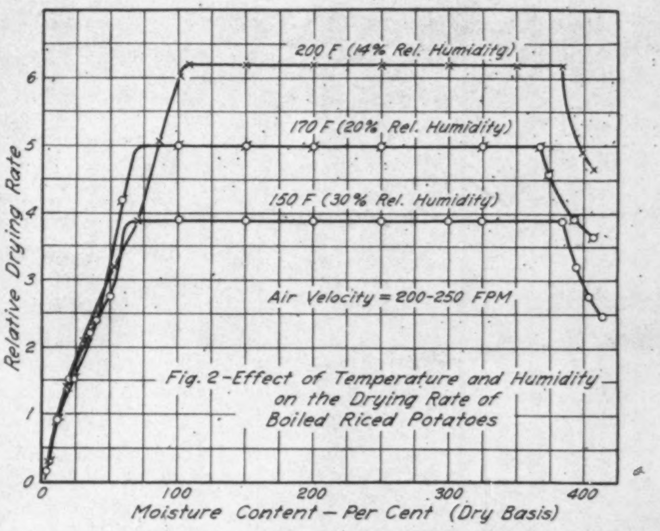


Fig. 2—Effect of Temperature and Humidity on the Drying Rate of Boiled Riced Potatoes

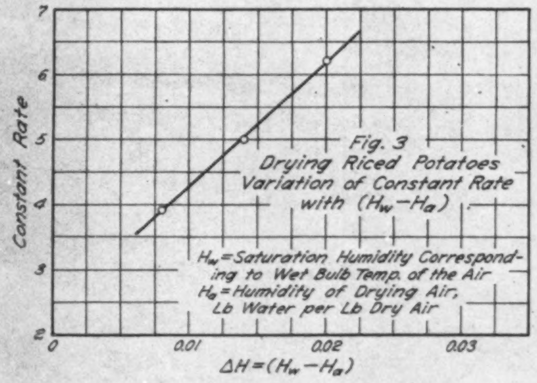


Fig. 3 Drying Riced Potatoes Variation of Constant Rate with (H_w-H_a)

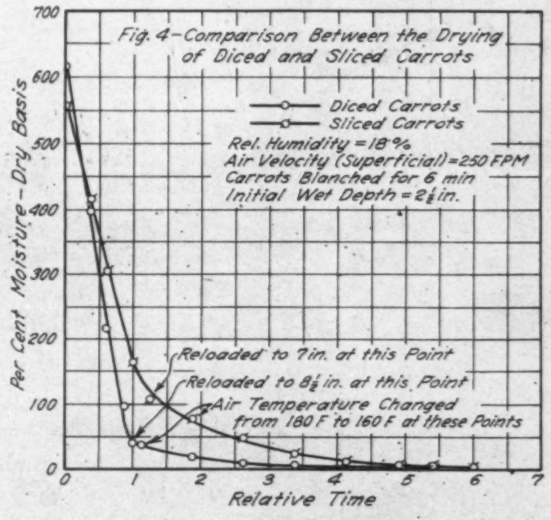


Fig. 4—Comparison Between the Drying of Diced and Sliced Carrots

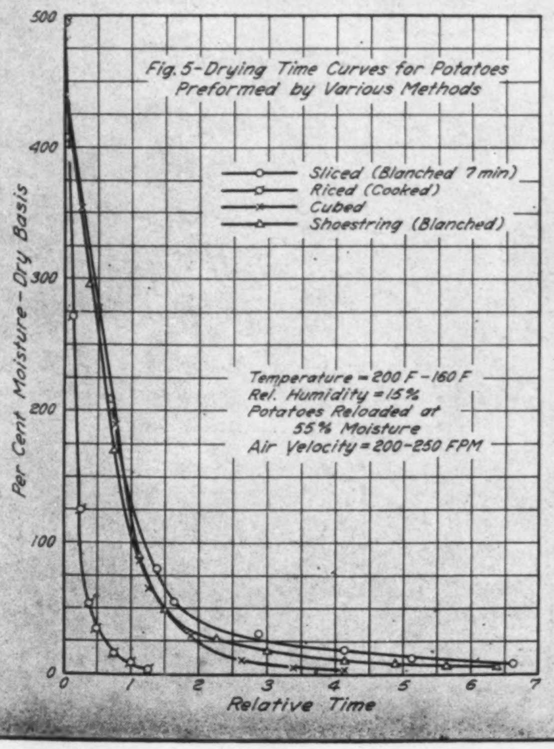


Fig. 5—Drying Time Curves for Potatoes Preformed by Various Methods

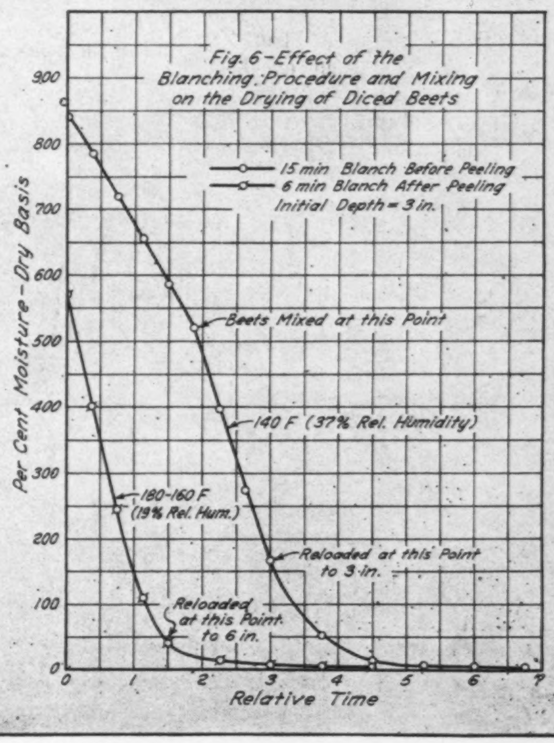


Fig. 6—Effect of the Blanching Procedure and Mixing on the Drying of Diced Beets

humidity at this temperature and hence the driving force, $\triangle H = (H_w - H_a)$, where H_w = absolute saturation humidity, lb of water per lb of dry air, corresponding to the wet bulb temperature of the air; and H_a = humidity of the air, lb of water per lb of dry air. The variation in the constant rate with $\triangle H$ is shown in Fig. 3, and it verifies the linear relationship postulated by the equation for the constant rate

$$\frac{dW}{A\,d\Theta} = k\,G^n\ (H_w - H_a) = k\,G^n\ \triangle H \ldots\ldots [1]$$

where

$\frac{dW}{A\,d\Theta}$ = constant drying rate, lb of water per hr per sq ft;

k = mass transfer coefficient;

G = mass velocity of the air, lb per hr per sq ft;

n = constant.

Although it has generally been the custom to express drying coefficients in terms of mass transfer, it is important to recognize that drying data in the constant rate period are more reliably correlated by means of a heat transfer coefficient than by means of a mass transfer coefficient (6). The reason for this is due to the fact that small errors in the value of the surface temperature may cause very large errors in the values of humidity or vapor pressure differences used in the driving force term of equation 1. For this reason, equation 1 should be written, for correlation purposes, as

$$\frac{\lambda\,dW}{d\Theta} = h\,A\ (t_a - t_s) \ldots [2]$$

where

$\frac{dW}{d\Theta}$ = lb of water evaporated per hr;

λ = latent heat of evaporation for water, Btu per lb;

h = heat transfer coefficient; Btu per hr per sq ft per F;

A = area of evaporation;

t_a = air temperature, F;

t_s = temperature of the drying surface, F.

The heat transfer coefficient, h, will vary as some power of the mass velocity, so that h could be replaced by $h'G^n$ in equation 2; n will lie between 0.6 and 0.8, depending upon whether through circulation or tray drying is used. The actual value of

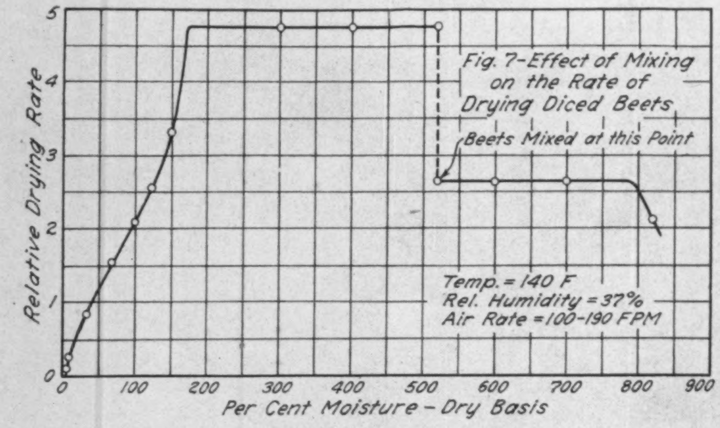


Fig. 7-Effect of Mixing on the Rate of Drying Diced Beets

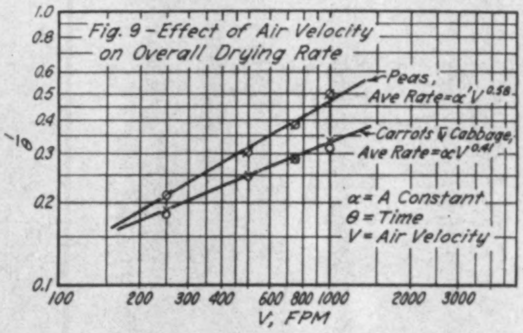


Fig. 9-Effect of Air Velocity on Overall Drying Rate

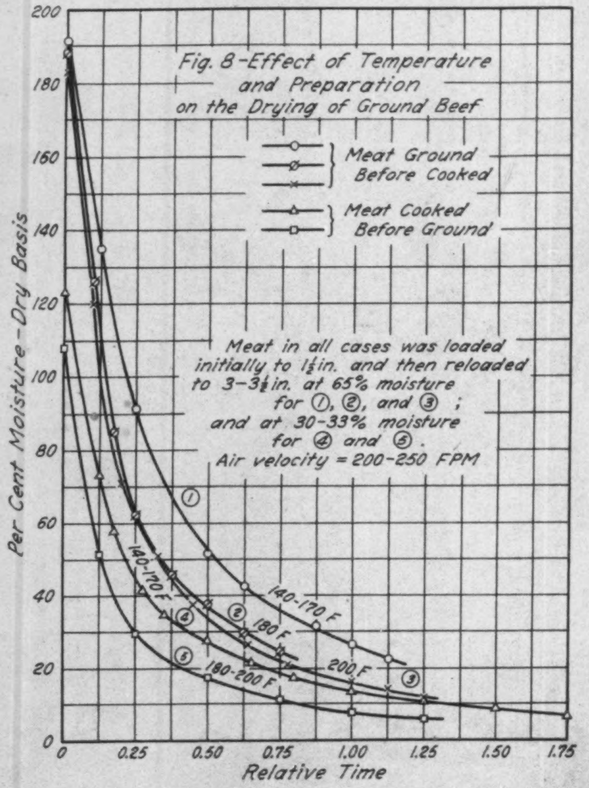


Fig. 8-Effect of Temperature and Preparation on the Drying of Ground Beef

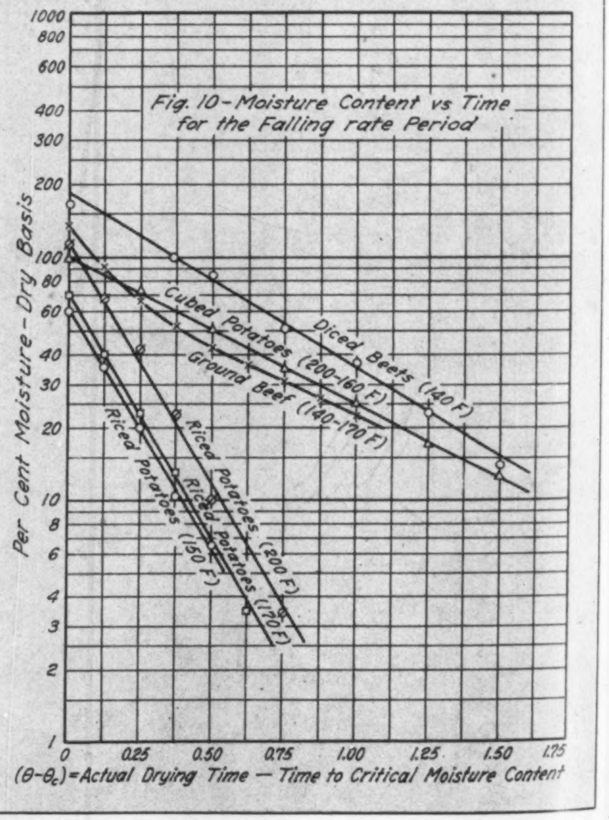


Fig. 10-Moisture Content vs Time for the Falling rate Period

h may be the result of a combination of conduction, convection, and radiation, and the magnitude of each effect will depend upon the drying conditions. If radiation and conduction play a large part in the drying process, it is then no longer permissible to assume that during the constant rate period the surface temperature is equal to the wet bulb temperature of the air.

In expressing the drying rate for through-circulation drying, the actual value of the area of evaporation is seldom known, so that a weight basis (lb of water per hr per lb of dry food) rather than an area basis is used to express the drying rate.

Effect of Method of Preforming

Figs. 4 and 5 indicate the effect of particle size on the drying time. The general effect of decreasing the particle size is to increase the constant rate and its extent. The reason for this is the increased area provided by the small particles, and the decreased distance of internal moisture movement. Since the drying rate is directly proportional to the area exposed, a noticeable effect is produced by finely subdividing the food. A distinctly greater constant rate is obtained for diced carrots than for sliced, as Fig. 4 indicates. The extreme effect of ricing potatoes is shown in Fig. 5. The fact that the other three methods of pre-

Drying Data for Various Foodstuffs

PRODUCT	PREPARATION OF RAW MATERIAL	PER CENT OF RAW PRODUCT YIELDED FOR DRYING	MODE OF SUBDIVISION	TRAY LOADING,[2] LB PER SQ FT (APPROX.)	USUAL TREATMENT PRIOR TO DRYING	TIME OF TREATMENT MIN	RANGE OF DRYING TEMPERATURE, F	AVERAGE DRYING TIME, HR	FINAL MOISTURE CONTENT PER CENT (DRY BASIS)	AVERAGE DRYING RATE[3] LB EVAP. PER HR PER SQ FT
Fruits:[1]										
Apples	peel, core, trim	65-75	cubed or sliced	1.5-2.0	sulfur	15-30	140-160	6-10	10-15	0.15
Apricots	wash, halve, stone	90-94	halved	2.0	sulfur	15-25	135-155	10-20	15-20	0.11
Bananas	stem, peel	52-57	left whole or sliced	1.0	sulfur	15-30	140-160	10-20	15-20	0.047
Cherries(unpit.)	wash, stem	97-99	left whole	1.0	steam, if any	0-2	135-160	8-12	15-20	0.072
Cherries(pit.)	wash, stem	77-83	left whole	1.0	steam	0-2	135-160	8-12	15-20	0.074
Cranberries	wash, stem	100	chopped	0.8-1.0	steam	0-2	135-150	4-8	5-10	0.120
Figs	wash	100	left whole	3.0	boiling lye dip	1/12-1/2	135-160	10-20	15-20	0.150
Grapes	stem	80-90	disper. of clusters	3.5	boiling lye dip	1/12-1/2	150-180	20-30	15-20	0.10
Loganberries	wash	100	left whole	1.2	none		140-150	10-15	10-15	0.08
Peaches	halve, pit, peel	85-90	halved	2.5	sulfur	15-30	145-155	15-24	15-20	0.10
Pears	peel, halve, core	75-80	halved	2.5	sulfur	15-30	140-150	15-24	10-15	0.10
Prunes	grade for size	100	left whole	3.0	boiling lye dip	1/6-3/4	145-160	20-30	15-20	0.077
Raspberries	wash	100	left whole	1.0	none		140-150	10-15	10-15	0.07
Rhubarb	trim, wash	55-60	sliced	1.0	steam	2-4	140-150	10-15	5-10	0.074
Vegetables:[1]										
Beans(green)	trim, wash	87-92	cut in 3/4 in. lengths	0.8-1.0	steam	15-20	140-155	8-12	5-10	0.07
Cabbage	trim	80-85	sliced or shredded	1.0	steam	2-6	140-150	8-12	5-7	0.09
Carrots	wash, peel, trim	77-82	cubed, sliced, or shr.	1.5	steam	4-8	150-160	8-12	5-10	0.13
Celery(stalks)	trim, wash	77-82	sliced or shredded	1.0	steam	1-2	135-145	8-10	5-10	0.10
Corn	husk, cut from cob	35-40	whole kernels	1.7	steam	15-20	150-165	5-10	5-10	0.17
Onions	trim	86-93	sliced or shredded	1.2	steam	1/2-3/2	135-140	5-10	5-7	0.14
Parsnips	wash, peel, trim	77-82	cubed, sliced, or shr.	1.2	steam	2-5	150-160	8-12	5-10	0.096
Peas(sugar)	shell, clean, grade	55-60	left whole	1.0	boiling water	1-2	140-150	8-12	5-10	0.08
Potatoes	wash, peel, trim	78-82	cubed, sliced, or shr.	1.2	steam or boiling water	5-7	145-155	8-12	5-10	0.092
Pumpkin	wash, stem, cut, seed	70-75	cubed, sliced, or shr.	1.5	steam	3-6	140-155	12-16	5-10	0.10
Squash	wash, stem, cut, seed	70-75	cubed, sliced, or shr.	1.5	steam	3-6	140-150	14-18	5-10	0.08
Spinach	trim, wash	45-55	leaves left whole	0.5	steam	2-5	140-180	6-10	5-7	0.057
Sweet Potatoes	wash, peel, trim	75-80	sliced	1.5	steam	6-8	150-160	5-10	5-10	0.13
Tomatoes	wash, trim, peel	70-85	sliced	1.2	none or steam	0-3	140-150	10-14	5-8	0.094
Turnips	wash, peel, trim	75-80	cubed, sliced, or shr.	1.2	steam	2-5	145-155	9-12	5-7	0.11
Other foods:										REMARKS
Breakfast Cereal							240	4.0	1	Initial moisture = 37 per cent
Casein							100-140	0.7-8		Drying time depends on type of dyes used. Short time corresponds to through-circulation.
Cheese			grated				110	1.17	22	Initial moisture = 54 per cent
Coconut			shredded				145-155	4-6		
Coffee			whole beans, or gr.				160-180	24		
Dessert Powder							110	1.5-5		Initial moisture = 4 per cent
Eggs	break, separate		sprayed				200-250	1/60	5-8	Time is for spray drying; eggs are also dried in trays.
Macaroni	dough forced through dies		wet strings	strings hung on sticks			90-110	18-36	8	Careful control of humidity required
Meat			sliced, ground, chipped		pre-cooked at 165 F	30-40	140-160	1-2	5-10	Drying time is for through-circulation drying
Milk			disp. by spraying				200-250	1/60	3-5	Drying time is for spray drying; milk is also dried on drum dryers.
Nuts	shell		whole kernels				75-140	18-24		
Peppers			sliced				190	0.2-0.433	5	Initial moisture = 354 per cent
Starch	filter		scored on filter				180-200	1/2	10-15	Drying time is for through-circulation drying
Sugar	crystallized from solution		form of crystals				150-200	1/2	2-3	Sugar is generally dried in a rotary dryer.

[1] The data for fruits and vegetables were obtained from a U. S. Department of Agriculture Circular 619, by Chace, Noel, and Peace.

[2] Depth of loading not specified, but probably around 1 1/2 to 2 in. deep.

[3] Overall rate based on the time required to go from the initial moisture content to an average final moisture content. These rates apply to tray drying in which air blows horizontally over the food in the tray.

forming potatoes (stripping, dicing, and slicing) show no appreciable difference in drying time indicates that the particle thicknesses and areas were about the same although the shapes of the pieces differed. It has been shown (3) that the constant rate for through-circulation drying will vary about as the —0.44 power of the particle thickness.

It is to be noted that the air temperature used for carrots was 180 F at the start. This is higher than the temperature usually recommended for carrots, but the cooling effect during the constant rate period kept the material itself at about 120 to 125 F. Close temperature control throughout the drying cycle can be obtained in the continuous through-circulation type dryer.

Effects of Other Variables on Drying Time

Fig. 6 indicates the effects of two different blanching procedures on the drying of diced beets as well as the effect of mixing the material during drying. When the beets were blanched in steam for 15 min and then peeled, the initial moisture content was higher than when blanching was done for 6 min after peeling. When the dried beets which were peeled after blanching were reconstituted, a very dark red product was obtained, while in the second case the beets returned to their natural color. The higher air temperature of 180 F gave a satisfactory product.

The effect of mixing the beets is best illustrated by means of a rate curve as shown in Fig. 7. It is to be noted that two constant rate periods were obtained. This can be explained on the hypothesis that mixing opened up the layer of beets and provided a greater area for evaporation. This procedure can readily be performed in a continuous conveying screen dryer by means of a so-called "kicker" which extends across the width of the conveyor.

In Fig. 8, the effects of temperature and the grinding procedure on the drying of ground beef are shown. As is to be expected, higher air temperatures decrease the drying time.

When the meat is ground before cooking, it possesses an initial moisture content which is as much as 70 to 80 per cent (dry basis) higher than the meat which was cooked and then ground. In the former case the meat was cooked for 45 min and centrifuged for 2 min. The ground beef under these conditions did not form a good permeable bed on the screen. In the latter case, the fat was removed first and the meat cooked in a steam jacketed kettle. The meat and juices were then run through a grinder with 3/16 in. perforations. This material handled much more readily for through-circulation drying.

In most of these tests the effect of air rate has not been mentioned. However, it was noted previously that the constant rate of drying varies in proportion with the 0.6 to the 0.8 power of the air velocity. Also, the range of air velocity for through circulation is kept at around 200 to 250 fpm for design purposes.

Fig. 9 presents data of Christie and Matsumoto (2) on the effect of air rate in the tray drying of peas, carrots, and cabbage. Their data have been correlated on log-log paper as reciprocal time vs. air velocity. The resulting curves show that the average overall drying rate varies with the 0.41 to the 0.58 power of the linear air velocity. The variations in the exponent on velocity are due to the fact that the data include the falling rate period, and thus the magnitude of the exponent depends on the ratio of the extent of the constant rate period to the extent of the falling rate period.

Falling Rate Period

In order to determine the nature of the function $f(W)$, shown in equation 6 on p. 673 of the November HPAC, the lower portion of the time curve for some foods was plotted on semi-logarithmic coordinates and the results are shown in Fig. 10. In most instances, except in the case of meat, straight lines result. This indicates that for the last portion of the drying time curves for beets and potatoes, equation 7 on p. 673 of the November HPAC may apply, or $f(W) = aW$.

Other Data

Additional drying data on fruits, vegetables, and other foods are presented in the accompanying table. These data can be used for estimating drying times for various foods, dried in a manner and under the conditions reported, from which "high spot" estimates of dryer sizes can be made.

The data in this table for fruits and vegetables were obtained from a Department of Agriculture circular (1), and these figures apply to tray drying in which air is blown across or over a tray of the food. It is of interest to note that when the air blows down *through* a bed of material the drying time may be reduced to almost half of the tray drying time. The drying rates listed in the last column were calculated from the data given in the circular, and these rates are overall figures based on the final moisture contents as shown.

References

(1) Chace, E. M., Noel, W. A., and Pease, Commercial Dehydration of Fruits and Vegetables, U. S. Dept. of Agric., Cir. 619, 1941.

(2) Christie, A. W., and Matsumoto, K., Study of Air Velocity and Temperature in Vegetable Dehydration, Report of Fruit Production Div., Univ. of Calif., 1925.

(3) Marshall, W. R., Jr., and Hougen, O. A., Drying of Solids by Through-Circulation, Trans. Am. Inst. Chem. Engr., 38, 91-121, 1942.

(4) Marshall, W. R., Jr., Drying of Foods, Heating, Piping & Air Conditioning, 14, 588-591, 1942.

(5) Marshall, W. R., Jr., Drying of Foods, Heating, Piping & Air Conditioning, 14, 671-73, 1942.

(6) Shepherd, C. B., Hadlock, C., Brewer, R. C., Drying Materials in Trays, Ind. Eng. Chem., 30, 388-97, 1938.

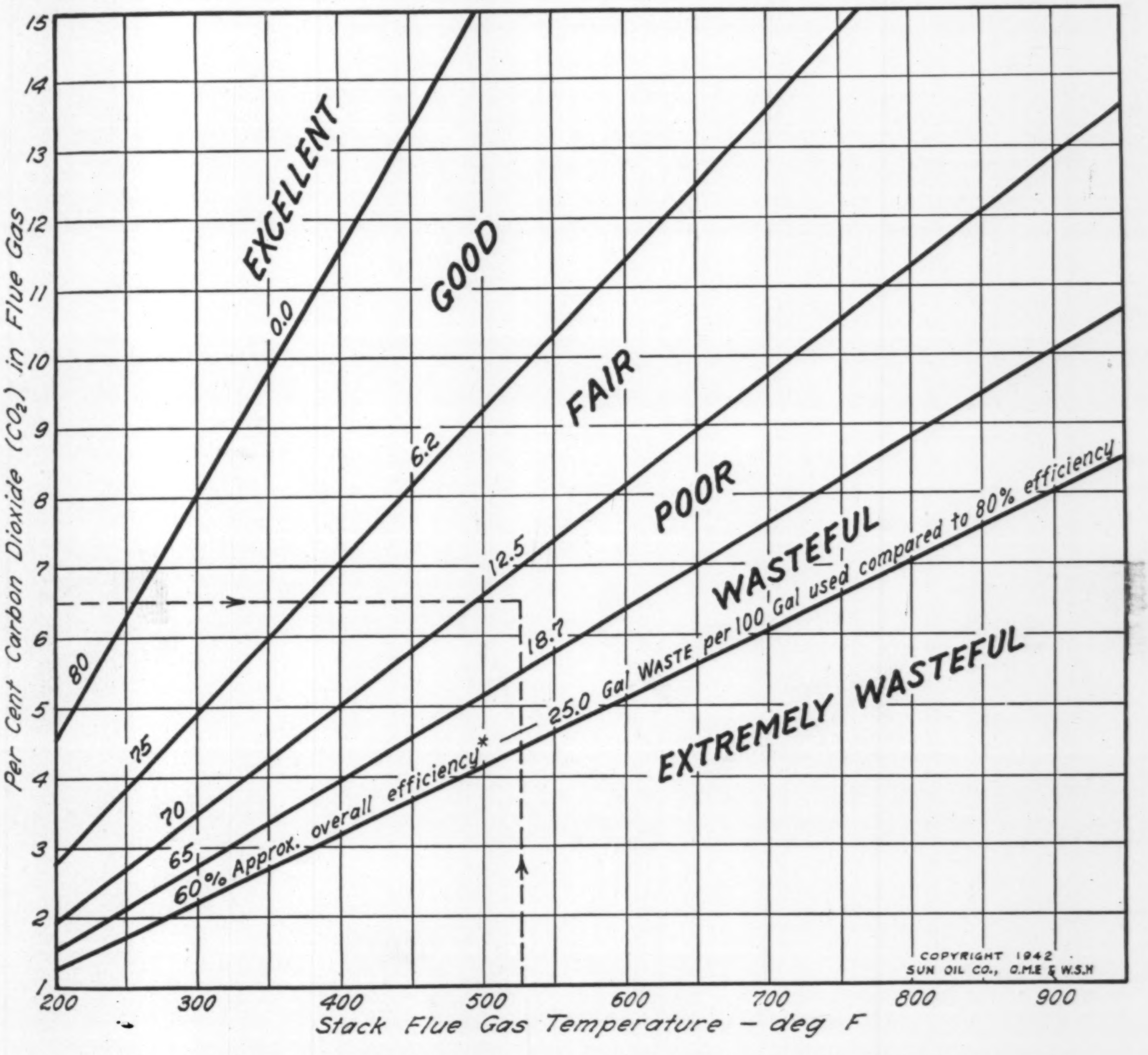
TO WPB'S VALVE AND FITTINGS SECTION

William F. Lahl, research engineer in the engineering and research division of Crane Co., has accepted an appointment on the "dollar a year" basis with the War Production Board. He will be consultant in the valve and fittings section of the WPB shipbuilding division.

The duties of this section have been considerably expanded since all WPB activities in the valve and fittings industry have been assigned to the shipbuilding division.

HEATING, PIPING & AIR CONDITIONING DATA SHEET

Chart for Estimating Fuel Oil Wasted



*NOTE: Includes a 7% "hydrogen moisture loss" and a 5% "radiation and unaccounted for loss".

EXAMPLE

6.5% carbon dioxide (CO_2) in flue gas; 525 F flue gas temperature
Approximate OIL WASTE = 14 Gal out of each 100 Gal compared to 80% Eff.

"LET'S GET DOWN TO FUNDAMENTALS"

Practical Application of Recent Developments in Theory to Air Conditioning Design Problems

William Goodman Assembles Basic Facts and Tells Their Significance in Simple Language

SUMMARY — Developments in the theory of air conditioning in recent years have made it possible to design practical air conditioning systems on a more rational basis than has hitherto been the case. Rational methods of design result in more nearly correct and suitably sized air conditioning systems. An incidental, but today equally important, result is the fact that rationally designed systems may also be economical ones. For example, air volumes selected by rational methods are frequently smaller than volumes selected by empirical methods. In these critical days when the conservation of raw materials is so vitally necessary, anything which contributes to a reduction in the size of equipment is of especial value. When the method of operation of an air conditioning system is changed, due to wartime conditions, best results are achieved if fundamentals are not disregarded. . . . The basic facts on the theory of air conditioning have been scattered through many different papers. In the article of which this is the first part, these facts have been gathered together and presented in a logical order which clearly shows the relationship between the various elements directly applicable to the design of air conditioning systems. No mathematical treatment is attempted. Instead, an attempt has been made to present in simple language a clear picture of the physical action taking place in the various component parts of air conditioning systems. . . . Mr. Goodman is consulting engineer, the Trane Co., and a member of HPAC's board of consulting & contributing editors

THE PSYCHROMETRIC chart is an invaluable aid in the design of air conditioning systems. More than this, it provides a simple and rapid means of understanding many otherwise complex phenomena in air conditioning. Many problems that are today simple and easy to visualize with the aid of the chart would require considerable work to visualize and solve without the aid of the chart. In the maze of curves and lines of the chart of Fig. 1 lies the ready and quick answer to many an air conditioning problem.

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The chart of Fig. 1 is no different from many others that have been published. There are vertical lines of dry bulb temperature and horizontal lines of dew point temperature. Lines of wet bulb temperature slope down from left to right, and the curves represent the relative humidity of the air.

As is well known, dew point temperature is the temperature at which moisture condenses from the air. Moreover, the dew point temperature is a direct indication of the quantity of moisture in the air. The greater the moisture content of the air, the higher will be its dew point temperature. The wet

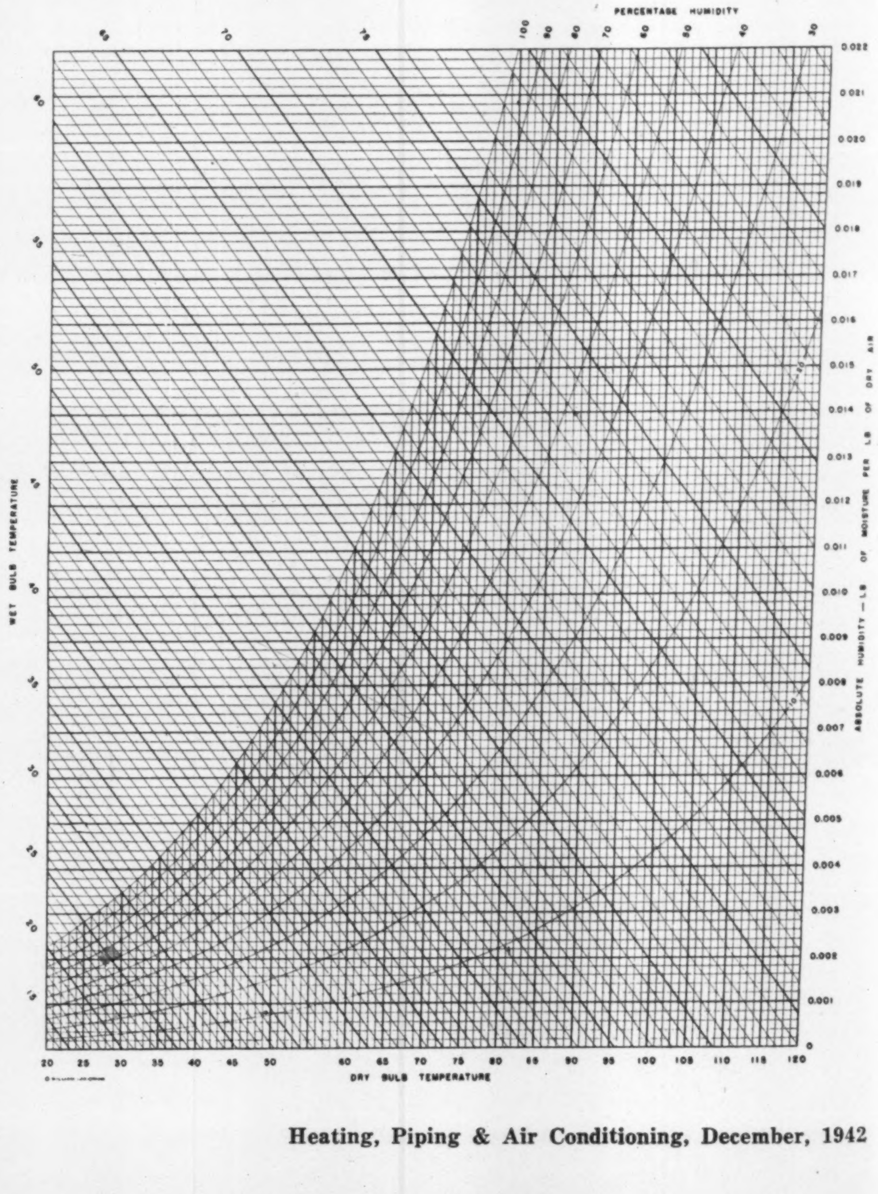

Fig. 1—Type of psychrometric chart used in analysis of coil performance [see p. 109, February, 1940, HPAC for larger reproduction of this chart]

bulb temperature, on the other hand, is the temperature at which moisture evaporates into a swiftly moving stream of air.

Heat Gains

In winter a room must be heated in order to offset the heat losses from the room. In the same way, in summer a room must be cooled in order to offset the heat gains of the room. However, in summer not only must the sensible heat gains of the room be removed, but also moisture must be removed from the air in the room in order to keep the air reasonably dry. Therefore, both sensible heat and moisture must be removed from a room in summer.

If a room is to be heated by means of warm air, the initial temperature of the air supplied to the room must be higher than the room temperature. As the air cools, it surrenders enough heat to offset the heat losses from the room. In the same way, in cooling a room the air must be supplied to the room at a temperature that is lower than the temperature of the room air. In this way, when the temperature of the cold air supply rises in the room, heat coming into the room is absorbed by the cold air. Furthermore, the chilled air supplied to a room in summer must have a lower moisture content—that is, a lower dew point temperature—than the air already in the room. In this way, the chilled air supply can absorb moisture in the room and maintain the desired dew point temperature in the conditioned room.

In designing an air conditioning system, the quantities of heat and moisture that must be absorbed are computed first. In addition, the dry bulb and dew point temperatures to be maintained in the room for comfortable conditions are generally given. Once the quantities of heat and moisture are known, it is a simple matter to compute the required dry bulb temperature and dew point temperature of the chilled air supply by first assuming the quantity of air to be supplied. Later, if a different air quantity is assumed and the computations repeated, a different pair of required dry bulb and dew point temperatures will be obtained. In the same way, by assuming a third and different quantity of chilled air, a still different pair of dry bulb and dew point temperatures will be obtained. In other words, the actual dry bulb and dew point temperatures that the chilled air supplied to the conditioned room must have depend upon the quantity of air that is supplied to the room.

Each of the required pairs of dry bulb and dew point temperatures obtained by computation can be represented by a point on the psychrometric chart of Fig. 2. If all three points representing the different required conditions of the chilled air supply are located on the psychrometric chart, all of these points will fall on a single straight line as in Fig. 2. In this figure, point *1* represents the condition that must be maintained in the conditioned room. The remaining points represent the required condition of the chilled air supply for different assumed quantities of chilled air. Consequently, it is apparent from Fig. 2 that for any given dry bulb temperature and relative humidity to be maintained in a conditioned room, the points representing the various conditions that the chilled air supply may have all fall on a single straight line on the psychrometric chart. This straight line is known as the "sensible heat percentage line."

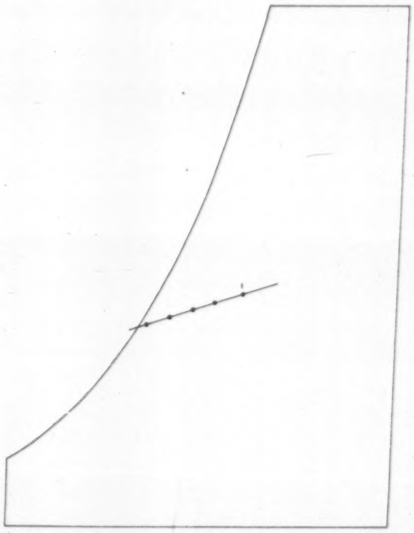

Fig. 2—On the psychrometric chart, points representing required dry bulb and dew point temperatures of chilled air supply all fall on straight line which passes through point representing condition of room

In order to draw the sensible heat percentage line, only the point representing the desired room condition and the sensible heat and moisture gains of the room need be known. The slope of the sensible heat percentage line depends only upon the ratio of the sensible heat gain of the room to the total heat gain of the room. Consequently, after the heat and moisture gains of the room have been computed, the sensible heat percentage line can be drawn directly on the psychrometric chart. The condition at which the chilled air is to be supplied to the conditioned room must be one which is represented by a point on the sensible heat percentage line for the conditioned room in question.

Selecting Condition of Air Supply

Of course, the weight of conditioned air to be circulated depends upon the point on the percentage line selected for the condition at which the chilled air is to be supplied. In Fig. 2, the closer the point representing the condition of the chilled air supply is to point *1*, which represents the room condition, the greater will be the quantity of air that must be supplied. From this it would seem, offhand, that the condition of the chilled air supply is determined wholly by the weight of air to be supplied to the conditioned room. This is not the case. Before the condition of the chilled air supply can be selected, the designer of the air conditioning system must be sure that the condition selected is one which can be obtained with the equipment that is to be used to condition the air. For example, if equipment is to be provided so that air in any state along the sensible heat percentage line can be obtained, then the designer may select any combination of weight and initial state of chilled air that is dictated by his experience or by other considerations that affect the design of the system. On the other hand, if a minimum of equipment is to be provided, then the selected initial state of the air must be one that can be obtained with the actual equipment that will be provided to chill and dehumidify the air supply.

If the choice of points representing the initial state of the air supply is dictated by the limitations of the air conditioning equipment, then the designer of the system has no option but to choose whatever state can be obtained with the equipment. After this particular state has been chosen, the weight of air needed to maintain the required condition of the room can be selected. When using equipment which severely restricts the choice of the initial state of the air supply, the weight of air should never be determined until after the initial state of the air supply has been determined. If the weight of air is arbitrarily selected without any regard as to whether the air supply in the required state can be obtained from the equipment used to condition the air, the required condition of the room will not be obtained.

In air conditioning systems today, no one wants to use more equipment than is necessary to obtain the desired room conditions. For example, chilled air in any condition along the percentage line can be obtained by reheating the air. However, even if the air supply is not reheated, as long as the point representing the condition of the chilled air supply lies on the percentage line, the temperature and humidity that will result in the conditioned room will be the same as though the air were reheated. Therefore, if needless equipment is to be avoided, the air should be supplied in the condition at which it leaves the cooling coil. This is quite common practice today in systems where exact control of humidity is not needed.

If the common practice of supplying the air in the condition in which it leaves the cooling coils is followed, then the choice of points on the percentage line is severely restricted. If coils of a sufficient number of rows are used to satisfy the requirements of the average air conditioning installation, the air will usually leave the coils in a very nearly saturated state. Therefore, if the air is not to be reheated, the point selected for the initial condition of the air supply to the room must be one that is close to the saturation curve.

In order to select correctly the point to which the air supply should be conditioned so that the required temperature and humidity will be maintained in the conditioned room, it is necessary to understand the action of cooling coils. Once the way in which a cooling coil changes the condition of the air is understood, it will be easy to visualize what takes place and to make the correct selection of the condition of the chilled air supply.

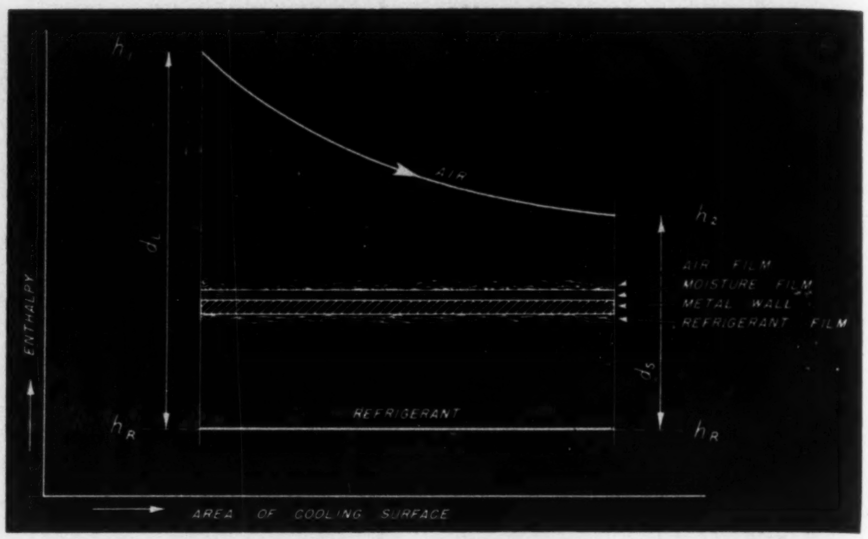

Fig. 3—Diagrammatic representation of air, moisture, and refrigerant films on metal wall of heat transfer surface (h_1 = heat content of entering air, Btu per lb; h_2 = heat content of leaving air, Btu per lb; h_R = heat content of air at the same temperature as the refrigerant, Btu per lb; $d_L = h_1 - h_R$; $d_S = h_2 - h_R$)

As previously stated, it has been the author's experience that where air volumes are selected after first selecting the condition of the air supply, the air volumes required are frequently considerably less than the volumes selected by various empirical methods, such as "room air changes" or according to the requirements of ventilation ordinances. Obviously, air volumes for air conditioning cannot be selected on the basis of "room air changes" or on the requirements of ventilation ordinances if the best possible results are to be obtained. Moreover, now that waste of materials and equipment must be avoided, there is more reason than ever for rationally selecting the quantity of air to be supplied.

Elements of Coil Action

In order to understand the action of coils when cooling and dehumidifying air, it is first of all necessary to appreciate the fact that the temperature of the metal forming the coil must be lower than the dew point temperature of the air entering the coil. The outside surface of a pitcher of ice water standing on a table soon becomes covered with a thin film of moisture condensed from the surrounding air. The reason, of course, is that the glass of which the pitcher is made has been chilled by the ice water to a temperature that is lower than the dew point temperature of the surrounding air. This is precisely the action that takes place in the coil. The metal of which the coil is made is chilled by the refrigerant. The temperature of the coil surface is usually lower than the dew point temperature of the entering air and, therefore, atmospheric moisture condenses on the surface of the coil. In order to chill the metal to a temperature lower than the dew point temperature of the air, the refrigerant inside the coil must be at a temperature that is lower than the dew point temperature of the air passing over the coil.

A fact that is not generally appreciated is that the surface of a coil is just as surely insulated as though it were covered with a visible layer of insulating material. Air is a poor conductor of heat. No matter how swiftly air is moving past the surface of a coil, always in contact with the surface of the metal there is a stationary layer of air. The existence of such a layer has been proved by experiments on sections of airplane wings. The existence and knowledge of the properties of such air films is highly important in airplane work. In the same way, the properties of this stationary film of air are highly important in determining the performance of a coil. The layer of air in contact with the cold, wet surface is saturated with moisture. As can be seen in Fig. 3, the moisture condensed from the air is in immediate contact with the cold metal surface of the coil. In turn, in contact with the film of moisture is a stationary film of air. This stationary film of air is the buffer layer between the moving stream of air and the moisture on the coil.

The temperature of the buffer layer of air and of the moisture film below it is not constant throughout the coil. The temperature changes from the side of the coil where the air enters to the side where it leaves. The temperature of this saturated film of air depends upon the wet bulb temperature of the main stream of air moving through the coil. As the air flows through the coil, it has the highest wet bulb temperature at the entrance of the coil and the lowest at the outlet of the coil. In between, the wet bulb temperature of the air is continually falling as it flows through the coil. The easiest way to visualize this is to imagine an eight-row coil divided up into eight separate one-row coils. The temperature of the air film on each succeeding row is colder than the temperature of the air film on the row ahead of it. Now the air film and the moisture film are always at some temperature between the wet bulb temperature of the air flowing over the coil and the temperature of the refrigerant inside the coil. Inasmuch as the wet bulb temperature of the air is continually dropping from the inlet side of the coil to the outlet side, it is obvious that the temperature of the buffer air film must also be continually falling from the inlet side of the coil to the outlet. This is always true either for direct expansion coils in which the temperature of the refrigerant is constant, or for counterflow water coils, in which case the temperature of the refrigerant decreases toward the air exit side of the coil.

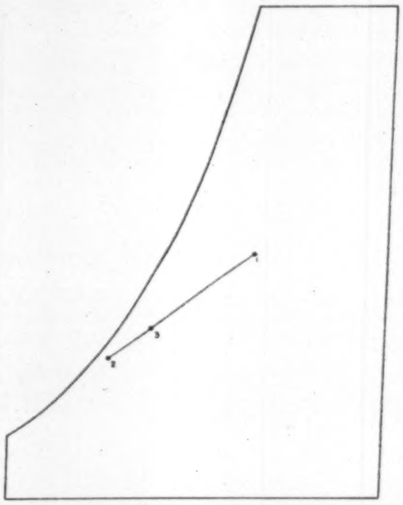

Fig. 4—Diagrammatic illustration on psychrometric chart of mixing of two streams of air

Air Mixtures

To understand how the buffer layer of air affects the performance of the coil, it is necessary to understand something of air mixtures. If two streams of dry air at different temperatures are mixed together, it is a simple matter to figure the temperature of the mixture, which will be somewhere between the original two temperatures. In the same way, if two streams of humid air are mixed together, the dry bulb temperature of the mixture will also be at some point between the dry bulb temperatures of the two original streams. In addition, the moisture content of the mixture will be somewhere between the moisture content of the original two streams of humid air. All of this can easily be visualized on the psychrometric chart. In Fig. 4, point *1* represents the original condition of one stream of air. Point *2* represents the original condition of the second stream of air. If these two streams of air are mixed together, the condition of the mixture can always be found quite simply on the psychrometric chart like that of Fig. 1. On such a psychrometric chart, the point representing the condition of the mixture always lies on the straight line joining the two points representing the conditions of the original two streams of air. Thus, in Fig. 4 point *3* on the straight line *1-2* represents the condition of the mixture of the two streams of air whose original conditions are represented by points *1* and *2* respectively.

The location of point *2* depends upon the relative weights of the original streams of air. If half the air came from source *1* and half from source *2*, line *1-2* of Fig. 4 would be divided into two equal parts, and point *3* would lie exactly half way between points *1* and *2*. On the other hand, if 25 per cent of the air in the mixture was originally in condition *1* and 75 per cent in condition *2*, then obviously the point representing the condition of the mixture must lie closer to point *2* than to point *1*. In this case, distance *2-3* of Fig. 4 would be 25 per cent of the length of line *1-2*. As a third example, if the greater part of the air were in the condition represented by point *1* and only an infinitesimally small part of the air were in condition *2*, then obviously the point representing the condition of the mixture would lie so close to point *1* as to be almost indistinguishable from it.

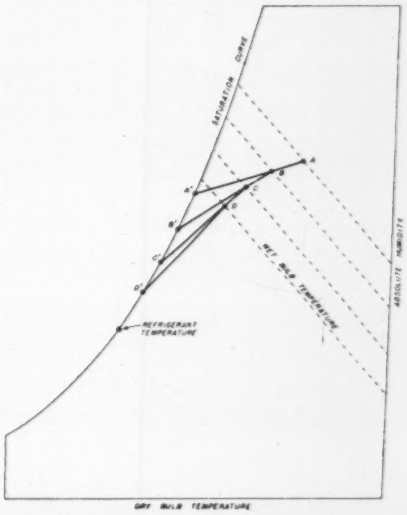

Fig. 5—Change in condition of air as it flows through dehumidifying coil can be represented by a series of straight mixing lines

Condition Curve

The action of a coil in cooling and dehumidifying air may be visualized as a mixing process. As the main warm stream of air flows past the cold surface film of air on the coil, continuous mixing takes place between the air in the surface film and the main stream of moving air. The main air stream is moving in turbulent, vigorous flow. It literally tears away small portions of the surface film and replaces the portions removed with air from the main stream. As a result of this mixing action between the relatively warm moist, moving air stream and the cold saturated surface air film, the main air stream is continuously being cooled and dehumidified.

The cooling and dehumidifying

of air by means of a mixing process can readily be visualized by means of the psychrometric chart of Fig. 5. Take again the illustration of an eight-row coil divided into eight separate one-row coils. The initial condition of the air entering the coil is represented by point *A* of Fig. 5. The air in the saturated surface film of this first one-row coil is at a temperature lower than the wet bulb temperature of the main air stream. Therefore, the condition of the air in the surface film must be represented by a point such as *A′* on the saturation curve. As the main air stream passes over the first row, mixing takes place between this main air stream in the condition *A* and the air in the surface film in the condition *A′*. As a result, the air leaving the first row is a mixture whose condition is represented by point *B*. In other words, the air flowing over the first row of the coil has been cooled and dehumidified from point *A* to point *B* by mixing. Now only an infinitesimally small portion of the surface film is driven into the main air stream. The distance between *A* and *B* is greatly exaggerated in Fig. 5 for the sake of clarity. Actually, point *B* would be very close to point *A* because so little air from the surface film enters the main air stream.

The air leaves the first row and enters the second row in the condition represented by point *B*. The temperature of the surface film on the second row is lower than the surface film on the first row. The condition of the surface film on the second row is represented by *B′* on the saturation curve of Fig. 5. Air in the condition *B* entering the second row mixes with the air in the surface film in condition *B′*. As a result, a mixture in condition *C* is obtained. Air in condition *C* now leaves the second row and enters the third row where the temperature of the surface film of air is still lower than in the preceding two rows. The condition of the surface film in the third row is represented by point *C′* on the saturation curve. Mixing again takes place and, as a result, air leaves the third row in the condition represented by point *D*. This mixing action is repeated in each row with which the main air stream is brought into contact until the air finally leaves the coil at the desired low temperature and humidity.

If a sufficient number of these straight mixing lines have been drawn in succession, a condition curve—the curve representing the condition of the air at any point in the coil—will be clearly outlined because it is the "envelope" of these lines. The condition curve itself appears as in Fig. 6. Any point on the condition curve represents the dry bulb temperature and dew point temperature of the air at some given point in the coil. Thus, the points in Fig. 6 show the condition of the air after leaving the second, fourth, and sixth rows. For a direct expansion refrigerant, with a constant temperature inside the coil, the condition curve must pass through the point on the saturation curve representing the refrigerant temperature. Only in a coil of infinite length can the air be cooled to saturation at a temperature equal to the temperature of the refrigerant.

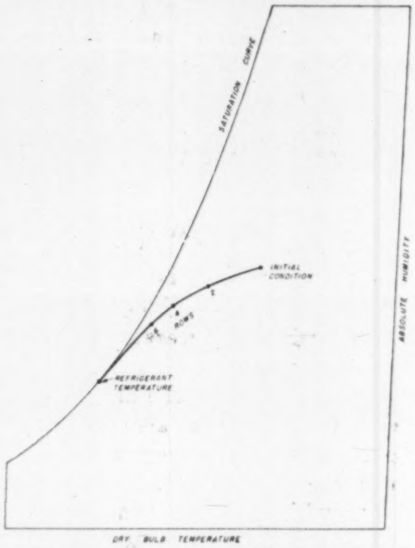

Fig. 6—Condition curve for dehumidifying coils. Points on this curve represent condition of air at various locations in coil

Although the condition curve can be drawn by using mixing lines, as explained in the preceding paragraphs, the curve is more easily drawn by computing the final dry bulb and wet bulb temperatures of the air by means of equations which have been developed. By computing a sufficient number of points by means of these equations, they can be plotted on the psychrometric chart and the condition curve clearly outlined.

An understanding of the condition curve and how it is drawn is helpful because it provides such a vivid picture of the change in the condition of the air as it flows through the coil. In addition, the condition curve is useful for illuminating many other phases of air conditioning—phases which might otherwise remain obscure without the simple explanations afforded by the use of the condition curve. These other phases are to be discussed in following sections of this article.

RETURN COMPRESSED GAS CYLINDERS AS QUICKLY AS POSSIBLE

The shortage of cylinders for chlorine, ammonia, carbon dioxide, and other compressed gases needed by many essential industries is becoming more and more acute, and, to prevent drastic restrictions in the distribution of these chemicals, all users and transportation companies must cooperate in returning the containers to the producers, warns R. J. Quinn of the Mathieson Alkali Works, Inc.

"Most users of compressed gases are probably trying to return their cylinders promptly, but many find that the railroads and the trucking companies are becoming increasingly unwilling to handle small shipments," states Mr. Quinn. "This situation can be remedied, however, if transportation managers fully understand the importance of getting cylinders back for refilling as quickly as possible, and if shippers of cylinders will cooperate with the transport companies in arranging shipments that can be handled economically.

"No new cylinders can be obtained, and the number being diverted from civilian use by our war effort is constantly increasing," Mr. Quinn points out, "but if all concerned will keep the available supply in constant circulation, it should be possible to serve satisfactorily all important users of compressed gases."

Heating·Piping & Air Conditioning

AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Journal Section

COUNCIL REVIEW

The Council held its regular quarterly meeting November 1 in Washington, D. C., with 14 of the 18 members in attendance. It received reports from several Committees and announced the dues rate for 1943, authorized railroad expense for Chapter Delegates and Council Members attending the Annual Meeting, approved the program for the 49th Annual Meeting and acted on requests for reinstatements, resignations and cancellations of memberships.

Approval of the appointment of Prof. C. M. Humphreys as Acting Director of the Research Laboratory was given. Future meetings of the Society will be streamlined as a matter of wartime policy, and the Executive Committee will recommend the location of future meeting places.

For the calendar year 1943 Initiation Fees and Dues will be as follows:

	Fees Initiation	Dues
Members and Associates	$10.00	$18.00
Juniors	5.00	10.00
Students	Nothing	3.00

An allotment of 40 per cent of dues paid by members and associates goes to the Research Fund. Dues of NEW MEMBERS will be prorated from date of election.

Reinstatement will be granted to former members whose resignations were accepted upon application and payment of prorated dues. For those whose membership was canceled for non-payment of dues, reinstatement will be effective upon payment of $18.00 fee and prorated dues for current year.

The Chapter Relations Committee reported 18 requests for fall meeting speakers, and the cost of this service to November 1 was $734.40. The committee was requested to study the effect of war conditions on chapter operations and it was the Council's opinion that it was important for chapters to carry on all regular meetings.

Appointment of a committee to study the appropriate procedure to establish a method of rating heavy duty warm air furnaces was recommended.

The Officers and the Council feel that during this first year of the world-wide war the Society has rendered important public service, effective cooperation to several government agencies and that the Society can take pride in the fact that many of its members are on active duty in the armed forces, while many more are serving at home to produce the weapons for winning the war.

To all, the Officers and Council desire to extend the Season's Greetings.

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Printed in U. S. A.

Comparative Resistance to Vapor Transmission of Various Building Materials

By L. V. Teesdale*, Madison, Wis.

SUMMARY — Asphalt-coated papers, duplex papers, plywood, and various other types of material employed for reducing moisture accumulation in walls were tested at the Forest Products Laboratory. An average vapor transmission rate of 0.6 grain per hour per square foot was considered the maximum acceptable for any group of specimens of a given material. The tests, together with field observations, indicate that walls, whether insulated or not, require protection against moisture accumulation and that effective vapor barriers are commercially obtainable

Introduction

For several years the Forest Products Laboratory[1] has been working on a study of the problems of condensation of moisture within walls and roofs of homes during cold weather. Such condensation arises as a result of the migration of vapor from the interior of a building through intervening materials to some surface cold enough to be below its dew-point temperature where it may be converted into either water or frost. The presence of moisture as a result of the condensation within walls or attic spaces may lead to undesirable after effects which not only increase maintenance costs but may also shorten the life of the structure. The most practical method known at this time of protecting a structure against condensation is to place on the warm side of the wall materials having high resistance to vapor transmission.

Since the amount of vapor that can pass through a material is inversely proportional to the resistance of the material to vapor transmission, the first phase of the study was to determine the comparative resistance of various building materials to vapor transmission. Plaster, plywood, fiberboards, coated papers, and other membranes were accordingly used as vapor barriers in test panels installed in an experimental house. Later a special project was set up to make a comprehensive study on various paper products and the results were published in the Tappi Technical Association Papers, Series 22-1939 under the title Comparative Resistance to Vapor Transmission of Commercial Building Papers. The transmission values in that report were given in grams lost per hour per square meter, a method of measurement commonly used in the pulp and paper industry. The transmission values of the various papers are here recalculated on a basis of grains lost per square foot per hour, a method of measurement more familiar to architects, engineers, and others connected with the construction industry.

Experimental Procedure

The method of test used is similar to the vapometer test as used by the pulp and paper industry but modified to adapt it to the materials being tested. The sample to be tested is sealed over a pan containing sufficient water to saturate the air space below the sample and the pan is placed in a room maintained at a constant temperature and humidity. A weight-time record is kept from which a curve is plotted showing the weight of vapor lost through the sample at each weighing. The curve at equilibrium becomes a straight line, the slope of which gives the equilibrium transmission rate.

Presentation and Discussion of Results

Table 1 is composed of several divisions, each containing the data on a certain class of material. Where paper products are sold in units of a different size, as, for example, roofing in rolls of 108 sq ft, the weight per 500 sq ft was calculated and entered in the table. The approximate retail price in 1938 for certain paper products was obtained either from local dealers or the manufacturers and quoted in terms of rolls of 500 sq ft. The tabulated values relating to the composition of materials are based upon questionnaires sent to the manufacturers. No inquiry was made as to their accuracy.

In judging the merit of a product, a tentative standard vapor transmission rate of 0.600 grain per sq ft per hr has been employed. From data obtained in tests in the laboratory test houses as well as observations and experience, it appears that vapor barriers having such resistance and located under the lath or on the warm side of the wall offer sufficient protection in houses maintaining 40 per cent humidity in normal winter weather having short periods of subzero weather.

Additional data on various species of plywood and glue, fiberboard products, and various miscellaneous products, together with details of the test procedure will be given later in ASHVE Transactions.

Tests of Papers

The highest resistance in any class of papers tested occurs in the saturated and coated felts or roll roofing materials, followed by sheets saturated and coated with asphalt. In the latter type it seems that the resistance is obtained by the surface coating and the total weight is not the important factor. The untreated duplex papers rank next in vapor resistance and appear to be more variable as a class than the saturated and coated products. The low price makes it attractive and the fact that it does not become brittle in cold weather is also a desirable feature. It does have a tendency to shrink if alternately wet and dry and should be installed with some slack so that it will not tear or break with moisture changes. Those grades having

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*Senior Engineer, Forest Products Laboratory, Forest Service, U. S. Department of Agriculture.

[1] Maintained at Madison, Wisconsin, in cooperation with the University of Wisconsin.

For presentation at the 49th Annual Meeting of the American Society of Heating and Ventilating Engineers, Cincinnati, Ohio, January, 1943.

Table 1—Permeability of various materials to water vapor

Company designation	Sample	Material	Remarks	Approximate price per roll 500 pounds (1938)	Weight per roll 500 pounds	Number of tests	Variation of test from average	Loss in grains per square foot per hour
	Number			Dollars			Percent	
		Single Sheets Sheathing and Roofing Products						
		Saturated with tar (tar felt)						
A	10	Slater's felt or tarred sheathing	53.2 percent saturated	1.25	32.0	3	0.6	9.020
B	40	25 pounds tarred sheathing	48.0 do	.94	25.0	3	1.4	12.650
B	41	String felt	50.0 do	2.24	44.0	3	.5	12.830
B	42	Slater's felt	40.0 do	1.08	30.0	3	2.5	9.815
B	55	25 pounds tarred felt	63.3 do	1.82	124.0	1	....	11.970
		Saturated with asphalt (asphalt felt)						
A	17	Insulating paper	42.0 percent saturated	1.90	25.0	3	8.3	2.380
A	20	Insulating paper	50.0 do	2.00	30.0	3	14.8	2.542
A	19	Insulating paper	47.0 do	2.25	35.0	3	8.9	2.802
A	21	Insulating paper	48.8 do	2.40	40.0	3	3.2	2.470
A	9	Insulating paper	44.5 do	2.80	45.0	3	6.1	3.970
A	14	Insulating paper	48.2 do	3.00	55.0	3	1.5	4.430
C	38	Waterproof building paper	43.2 do	1.16	25.0	3	12.6	12.840
C	39	Insulating paper	49.0 do	2.75	45.0	3	3.6	12.650
C	84	15 pounds asphalt felt	62.5 do	2.89	75.0	3	5.8	3.205
C	85	30 pounds asphalt felt	63.4 do	5.78	150.0	3	12.8	2.485
B	43	25 pounds asphalt sheathing paper	48.0 do	.94	25.0	3	4.2	6.204
B	44	30 pounds asphalt sheathing paper	40.0 do	1.08	30.0	3	1.9	6.100
		Saturated and coated with asphalt (sheathing paper)						
D	1	Coated sheathing paper		2.90	35.0	3	6.8	.727
A	15	do		2.25	35.0	3	16.0	.308
A	16	do		3.00	50.0	3	16.0	.158
C	37	do		2.80	35.0	3	17.6	.456
C	36	do		3.40	50.0	3	3.0	.592
B	45	do		2.24	35.0	3	6.3	.197
B	18	do		3.01	50.0	3	8.5	.364
E	56	do		2.20	35.0	3	18.7	.296
F	24	do		....	50.0	3	13.6	.407
G	119	do		2.01	35.0	3	27.0	.160
G	118	do		3.50	50.0	3	9.5	.259
H	70	do		....	38.0	3	0	.160
H	69	do		....	50.0	3	6.4	.191
B	64	do		3.01	50.0	3	1.8	.222
		Saturated and coated felts (roll roofing)						
I	130	Heavy saturated felts		4.40	125.0	2	2.1	.864
F	82	do		3.62	125.0	3	1.8	.099
E	81	do		3.70	157.0	3	0	.105
C	136	do		5.50	208.0	3	21.5	.185
C	137	do		11.50	254.0	3	25.6	.080
C	83	do		13.50	301.0	3	9.1	.068
		Duplex or Laminated Products. Untreated Kraft Asphalt Laminae Not Reinforced						
J	138	30-30-30		.88	15.6	3	2.6	.957
J	146	30-30-30		.88	15.6	3	10.0	1.012
J	147	30-40-30		.98	17.4	3	12.2	.561
J	139	30-50-30		1.03	19.1	3	2.1	.487
J	148	30-50-30		1.03	19.1	3	3.1	.456
J	149	30-60-30		1.12	20.8	3	3.0	.512
J	150	30-75-30		1.26	23.4	3	5.2	.357
J	140	30-95-30		1.45	26.9	3	1.4	.345
J	151	30-100-30		1.49	27.8	3	2.9	.364
K	164	30-30-60		....	20.9	2	13.8	.784
K	163	60-30-60		....	26.1	3	8.9	.345
K	165	30-60-30		....	20.9	3	4.0	.357
K	166	30-80-30		....	24.4	3	10.0	.290
K	167	30-100-30		....	27.8	3	10.4	.296
L	60	25-40-25		1.32	17.0	3	10.4	.592
L	59	30-45-30		1.50	18.0	3	36.9	.753
L	58	30-50-60		2.00	25.0	3	2.4	.777
L	57	60-50-60		2.62	30.0	3	13.0	.475
M	53	30-45-30		2.00	17.5	3	9.5	2.600
M	97	30-55-30		1.35	20.0	3	11.7	.846
N	30	30-30-30		1.62	15.5	3	27.0	3.530
O	25	30-70-30		2.50	22.4	3	8.7	.636
P	75	30-30-30		....	15.6	1	....	1.560
		Duplex or Laminated Products, Untreated, Creped						
N	29	Creped duplex		2.35	20.8	3	5.6	2.150
N	31	Creped duplex		3.50	42.0	3	4.0	.364
J	153	30-30-30 before creping		1.77	20.9	3	4.0	4.120
		Duplex or Laminated Products, Untreated, Reinforced						
O	6	30-80-30		5.00	29.0	3	7.9	1.018
Q	7	30-85-30		4.75	29.0	3	29.0	1.270
R	33	30-100-60		3.80	34.0	3	.7	.900
M	52	30-193-30		....	47.0	3	22.4	.660
L	61	30-110-30		3.75	33.0	3	10.9	1.690
L	62	30-80-30		2.62	25.0	3	12.4	.598
L	63	30-70-30		2.12	23.0	3	3.7	1.005
P	74	30-95-30		....	31.0	3	40.6	4.440
M	93	30-90-30		3.00	28.0	3	16.1	.574
M	95	30-70-30		3.00	25.0	3	6.7	.550
S	115	30-70-30		2.85	25.0	3	11.0	.784
R	35	Three sheets 30-pound kraft two layers asphalt 50 pounds		4.30	34.0	3	5.7	.722
		Treated Duplex or Laminated Products. One or More Sheets Saturated with Asphalt						
J	152	30-30-30 saturated both sides		.97	17.7	3	10.0	1.492
J	154	30-30-30 saturated both sides and creped		1.94	23.6	3	13.3	2.250
J	155	35-50-35 saturated both sides and creped		2.42	29.4	3	3.0	6.230
R	32	50-125-50 saturated both sides and creped		5.50	40.0	3	1.2	1.570
P	73	45-90-45 saturated two sides, reinforced		....	31.0	3	7.3	4.150
E	91	Heavy duplex -- one sheet untreated		1.72	90.0	3	4.1	.407
S	116	Three sheets -- two layers asphalt and reinforcing		4.50	33.0	3	8.4	.876
I	129	30-100-30 reinforced		3.50	32.0	3	11.3	.982
		Duplex Sheets with Reflective Coating -- Asphalt Laminae						
M	51	Coated wall paper		15.00	61.0	3	9.2	.401
M	54	Coated fabric, reinforced		17.50	55.0	3	19.1	.388
M	92	Coated double (30-60-30), reinforced		12.50	25.0	3	3.6	1.862
M	135	Coated double (30-60-30), reinforced		....	56.7	3	2.9	.357

Table 1 (continued)

Company designation	Sample	Material	Remarks	Approximate price per roll 500 pounds (1938)	Weight per roll 500 pounds	Number of tests	Variation of test from average	Loss in grains per square foot per hour
	Number			Dollars			Percent	
		Duplex Sheets with Miscellaneous Treatments and Coatings						
M...	8	30-85-30, reinforced, coal tar saturated in cover sheets		5.00	31.4	3	19.5	1.498
M...	26	30-75-30, not reinforced	do	3.00	25.5	3	3.8	1.130
M...	94	30-105-30, surface coated with asphalt and wax		4.50	32.0	3	2.6	.407
M...	96	30-130-30, reinforced with burlap		5.50	53.0	3	21.9	2.240
T...	104	30-25-30 waxed one side		1.08	15.0	3	4.1	.494
T...	105	Do	stripped from insulation			3	7.5	.536
		Plain Kraft Building Papers						
U...	28	Rosin sized sheathing paper			20.0	3	1.8	49.200
U...	27	Do			40.0	3	11.0	39.600
J...	142	Do			5.2	3	3.6	46.800
J...	143	Do			10.4	3	.7	43.200
J...	158	Do	Two sheets 30 pounds kraft		10.4	3	.5	40.500
J...	159	Do	Two sheets 60 pounds kraft		20.8	3	.8	36.900
		Papers Used in Commercial Packaging						
V...	3	Kraft soaked with wax (paraffin)			21.2	3	10.2	9.880
V...	4	Do			22.5	3	1.3	21.800
V...	5	Do			25.0	3	4.5	13.320
W...	133	Insulating paper used for wrapping		2.24	19.1	3	4.0	.469
X...	132	40 pounds kraft coated with synthetic elastic material				3	3.3	2.405
Y...	124	20 pounds paper with attached layer of waxy material				2	3.6	.432
Y...	125	40	do			2	6.0	.259
Y...	126	64	do			1		.277
		Insulation back-up papers--surface treated only						
T...	47	Single infused, new, ribbed			14.5	3	3.7	1.990
T...	72	Do			14.5	1		2.283
T...	77	Do			14.5	3	1.9	.648
T...	108	Do			14.5	3	25.6	3.455
T...	12	Single infused, stripped from insulation, ribbed			14.5	3	4.6	.935
T...	78	Do			14.5	3	3.6	1.204
T...	120	Do			14.5	3	32.8	.827
T...	106	Double infused, new, ribbed			15.0	3	8.1	2.655
T...	87	Double infused, stripped from insulation, ribbed			15.0	3	38.0	2.320
Z...		Stripped from insulation				2		.649
Z...		Stripped from insulation, ribbed				2		10.520
AA...		Back-up paper, stripped from insulation, ribbed				3		1.850
BB...		Do				3		.620
CC...		Do				2		1.962
T...	101	Double infused without ribs			10.0	3	1.8	1.675
T...	102	Do			12.0	3	24.8	1.141
T...	103	Do			14.0	3	11.3	2.621
T...	98	Do			12.0	3	22.8	1.515
T...	99	Do			16.0	3	42.1	3.140
T...	100	Do			24.0	3	7.2	3.540
		Single sheet--kraft--double infused						
T...	48	Building paper, light			12.0	3	3.2	1.940
T...	49	Building paper, medium			16.0	3	43.1	1.333
T...	50	Building paper, heavy			24.0	3	7.2	3.540
G...	117	Black kraft paper			14.3	3	4.4	6.960
		Miscellaneous Pulp and Paper Products						
DD...		Insulation, multiple corrugated board 1 inch thick, lightweight kraft				2		21.080
EE...		Ground newsprint bound with asphalt and composition 1 inch thick				3		27.400
FF...		2-1/8 inch corrugated boards coated, two-coated reflective surfaces				3		12.845
GG...		Corrugated board saturated with asphaltic oil						
HH...		Asphalt board 0.694 pound per square foot				3		8.500
		0.102 inch thick, soft felt face				3		.180
HH...		Asphalt board 0.817 pound per square foot 0.118 inch thick, hard texture face				3		.092
HH...		Asphalt board 0.838 pound per square foot 0.125 inch thick, soft felt face				3		.308

40 to 50 lb or more of asphalt in the middle lamina appear to be more consistent than where less asphalt is used. It does not appear that reinforcement is necessary in vapor barriers and since the reinforcement tends to lower the resistance to vapor transmission there is little excuse for their use as barriers. Saturating the cover sheets of duplex papers also appears undesirable as it seems to lower the resistance to vapor transmission without adding any desirable property for this class of service.

Plywood

The vapor resistance of plywood is greater than that of solid wood of the same thickness and species. No doubt the glue line offers some resistance and possibly the breaking up of the continuity of grain from one face to the other is also a contributing factor. The resistance of plywood to vapor transmission increases with an increase in the thickness and number of plies. The kind of glue used appears to affect the resistance through a rather wide range particularly in the artificial resin group. In only one case tested, however, was the resistance of the glue line high enough to equal the standard of resistance desired.

Effect of Changing Vapor Pressure Differences on Vapor Transmission

There have been a number of investigators making studies in this same field but no common method of testing has been followed. As

Table 1 (continued)

Company designation	Thickness	Species	Glue	Remarks	Number of tests	Loss in grains per square foot per hour: Low	High	Average
Plywood								
Commercial plywood vegetable glue								
II	Three-ply 1/4-inch	Douglas-fir	Soybean	No coating	1			4.500
Do	do	do	do	One coat asphalt paint	3	2.340	2.560	2.470
Do	do	do	do	Two coats asphalt paint	3	.586	.678	.617
Do	do	do	do	One coat aluminum paint	3	.985	3.960	1.660
Do	do	do	do	Two coats aluminum paint	3	.555	1.420	.925
Do	Five-ply 1/2-inch	do	do	No coating	2	1.920	1.970	1.940
Do	do	do	do	One coat asphalt paint	3	.740	1.110	.986
Do	do	do	do	Two coats asphalt paint	3	.246	.370	.290
Do	do	do	do	One coat aluminum paint	3	.986	1.080	1.030
Do	do	do	do	Two coats aluminum paint	3	.678	1.110	.845
Market	Three-ply 1/4-inch	do	do	One coat shellac	3	5.670	5.840	5.770
Do	do	do	do	One coat aluminum paint, two coats lead and oil paint	3	1.100	1.275	1.221
Commercial plywood artificial resin glue								
II	Three-ply 1/4-inch	Douglas-fir	Artificial resin	No coating	3	3.080	4.690	4.060
Do	do	do	do	One coat asphalt paint	3	1.730	2.030	1.910
Do	do	do	do	Two coats asphalt paint	3	.370	.617	.512
Do	do	do	do	One coat aluminum paint	1			2.160
Do	do	do	do	Two coats aluminum paint	3	.862	.986	.925
Do	do	do	do	One coat prime, one coat flat wall paint	1			1.910
Do	Five-ply 1/2-inch	do	do	No coating	3	1.970	2.410	2.190
Do	do	do	do	One coat asphalt paint	3	.493	.986	.722
Do	do	do	do	Two coats asphalt paint	3	.278	.432	.326
Do	do	do	do	One coat aluminum paint	1			1.110
Do	do	do	do	Two coats aluminum paint	2	.493	.710	.605
Market	Three-ply 1/4-inch	do	do	One coat shellac	24	3.640	4.640	4.064
Do	do	do	do	One coat aluminum, two coats lead and oil	9	.931	1.285	1.146
Do	Three-ply 3/8-inch	do	do	One coat aluminum, two coats lead and oil	3	1.133	1.471	1.298
JJ	Five-ply 1/2-inch	Poplar	do	No coating	2	.185	.400	.333
Do	do	do	do	Two coats aluminum, two coats lead and oil 3 years exposure	1			.216

may be expected, the tests do not cover the same materials though one or more similar materials may appear in the lists of two investigators making it possible to compare values at least on those materials common to both lists. An effort has been made by others to bring the values obtained by different investigators into one general table by calculation. This is based on the assumption that vapor transmission is directly proportional to the differences in vapor pressure on opposite sides of the test material and that, where the vapor pressure differences are known, it is possible to determine by calculation a common vapor pressure difference that covers the results of several investigators.

Some limited investigations made in connection with the vapor transmission study, however, indicate that this method of comparison is not accurate and may be subject to serious errors. Apparently vapor transmission is not directly proportional to vapor pressure differences in all cases, particularly where materials that are hygroscopic are involved. Since many of the materials with which we are concerned in building construction are more or less hygroscopic, it would appear that there is little promise at present of comparing the results of different investigators by calculation.

After completing the regular tests in the 30 per cent relative humidity room, a number of test pans were placed in the 65 per cent relative humidity room and weighings continued. The test material represented six lots of three pans each of Douglas-fir having various coatings of aluminum paint. Both the 65 and the 30 per cent relative humidity rooms were maintained at 80 F; therefore, the exposure reduced the difference in vapor pressure on opposite sides of the test specimen by 50 per cent and it might be expected that vapor losses would be in the same order. In the first group of 18 pans, however, it was found that the loss was reduced an average of only 27 per cent; the maximum was 42 per cent, and the minimum 12 per cent. The results are tabulated in Table 2, first cycle. Later a few more pans were available and the same tests made with similar results, which are also tabulated in Table 2, first cycle. Most of the samples were Douglas-fir plywood with various coatings, mostly aluminum, but the tests also included some fiberboard materials used for sheathing. The differences between individual test specimens in each lot of the Douglas-fir group in the 30 per cent relative humidity room were characteristic of other tests made, and each group may be regarded as reasonably consistent within itself. With the exception of two lots, the same was true in the 65 per cent relative humidity room insofar as consistency within groups was concerned.

The exceptions were sample lots 10 and 12 covered with oiled and painted cloth where the weights in the 30 per cent room never reached an equilibrium but continued to increase slightly during the period of test. This condition was not apparent in the weighings made on lot 11, though covered with a similar material.

The fiberboard materials, with one exception, acted about the same as the plywood. The exception was a sample having a very high rate of transmission and in this case the rate of transmission was essentially proportional to the difference in vapor pressure.

After the first cycle of tests in the 30 and 65 per cent relative humidity rooms had been completed the second series was run through a second cycle. This meant moving the pans from the 65 per cent room back to the 30 per cent room and later again to the 65 per cent room. The results of this test are shown in Table 2, second cycle. Without exception the rate of loss in the 30 per cent room was higher during the second cycle than during the first. When the pans were returned to the 65 per cent room, with three exceptions the loss was consistent with the results of the first cycle through these same rooms.

Table 2—Relation of moisture loss in 30 per cent relative humidity room compared to that in 65 per cent relative humidity room

Sample	Material		First cycle			Second cycle			Percent increase in 30 percent room second cycle compared to first cycle	Percent change in 65 percent room second cycle compared to first cycle
			Average loss in grains per square foot per hour		Percent loss in 65 percent room compared to 30 percent room	Average loss in grains per square foot per hour		Percent loss in 65 percent room compared to 30 percent room		
			30 percent room	65 percent room		30 percent room	65 percent room			
Number										
1-1	5/16-inch Douglas-fir plywood	One spray coat 1 pound aluminum primer one side One brush coat 1-3/4 pounds aluminum primer other side	2.505	1.452	58.0					
1-2	Do	do	2.435	1.480	60.8					
1-3	Do	do	2.540	1.770	67.0					
2-4	Do	One brush coat 1-3/4 pounds aluminum primer one side One brush coat 1-3/4 pounds aluminum primer other side	4.090	2.855	69.8					
2-5	Do	do	3.830	2.664	69.6					
2-6	Do	do	4.060	2.800	69.0					
3-7	Do	One spray coat 1 pound and one 1 brush coat 1-3/4 pounds aluminum primer one side One brush coat 1-3/4 pounds aluminum primer other side	3.230	2.270	70.3					
3-8	Do	do	3.065	2.190	71.5					
3-9	Do	do	3.410	2.440	71.6					
4-10	Do	One brush coat 1-3/4 pounds aluminum primer one side One brush coat 1-3/4 pounds aluminum primer other side	2.915	2.004	68.7					
4-11	Do	do	2.800	2.090	73.6					
4-12	Do	do	3.170	2.428	76.6					
5-13	Do	One spray coat 1 pound aluminum primer one side One brush coat 1-3/4 pounds aluminum primer other side	1.400	1.030	73.5					
5-14	Do	do	1.650	1.215	73.6					
5-15	Do	do	1.675	1.215	72.5					
6-16	Do	One spray coat 1-3/4 pounds aluminum primer "C" one side One brush coat 1-3/4 pounds aluminum primer "C" other side	1.556	1.378	88.6					
6-17	Do	do	1.690	1.480	87.5					
6-18	Do	do	1.730	1.508	87.2					
7-19	Do	One brush coat 1 pound aluminum primer "D" one side One brush coat 1 pound aluminum primer "D" other side	3.616	2.765	76.5	4.320	2.765	64.0	19.0	± 0.0
7-20	Do	do	3.562	2.675	74.8	4.160	2.810	67.5	17.0	+ 6.0
7-21	Do	do	3.990	2.930	71.0	5.210	2.965	57.0	30.0	+ .5
8-22	Do	One brush coat 1-3/4 pounds aluminum primer "D" one side One brush coat 1-3/4 pounds aluminum primer "D" other side	2.215	1.793	80.4	3.035	1.845	60.8	37.0	+ 3.0
8-23	Do	do	3.142	2.452	78.0	4.230	2.600	61.5	34.0	+ 6.0
8-24	Do	do	3.535	2.765	78.0	4.360	2.600	59.5	23.0	- 6.0
10-25	Do	Oiled and painted cloth one side	1.768	2.030	[1]15.0	2.705	2.155	79.4	53.0	+ 5.0
10-26	Do	do	1.742	2.484	[1]43.0	2.800	2.200	78.5	60.0	-12.0
10-27	Do	do	1.768	1.622	92.0	2.135	1.805	88.7	22.0	+11.0
11-28	Do	Oiled and painted cloth one side One brush coat 1 pound aluminum primer "D" other side	5.866	4.550	77.4	6.590	4.190	63.5	12.0	- 8.0
11-29	Do	do	5.620	4.222	75.0	6.240	3.870	62.0	11.0	- 9.0
11-30	Do	do	6.660	4.830	72.5	7.170	4.350	60.6	7.0	-10.0
12-31	Do	Oiled and painted cloth plus 1 pound aluminum primer one side One coat 1 pound aluminum primer other side	1.262	1.500	[1]18.8	2.280	2.020	88.7	81.0	+34.0
12-32	Do	do	1.238	1.607	[1]30.0	2.210	1.890	85.5	79.0	+18.0
12-33	Do	do	1.213	1.420	[1]17.0	2.180	1.890	86.6	80.0	+33.0
12-34	3/4-inch fiberboard sheathing coated		5.920	3.830	64.6	7.380	3.430	46.3	24.0	-10.0
12-35	Do		6.490	3.680	56.6	6.530	3.300	50.5	.5	-10.0
12-36	Do		5.860	3.560	60.7	6.940	2.505	36.2	18.0	-30.0
12-37	Do		2.030	1.630	80.2	3.300	2.025	62.3	62.0	+16.0
12-38	Do		19.008	9.360	49.2					
12-39	Do		1.132	.925	81.6	1.550	.893	57.6	37.0	- 4.0

[1] Gain

There are insufficient data available to explain these inconsistencies, but it is apparent that factors, other than differences in vapor pressure, affect vapor movement through hygroscopic materials.

Evaluation of Vapor Barriers

The information available from which it is possible to evaluate the optimum resistance desired in a vapor barrier is quite limited. However, studies made over a period of years in the Laboratory test house do show first the importance and necessity of a vapor barrier and second, within certain limits, the degree of resistance desired. In walls of conventional frame construction consisting of plaster, studs, sheathing and wood siding, experience has taught that moisture accumulating in the wall gathers principally in the sheathing, hence a record of the moisture content of the sheathing may be used to determine the efficiency of a moisture barrier. The test house walls were divided into panels, some with insulation, some without, some having no moisture barrier, others having moisture barriers varying in resistance. Since the temperature and humidity conditions within the test house were maintained constant at 72 deg and 42 per cent relative humidity the exposure was essentially the same for all panels. The house was protected so that no variable would be introduced by exposure to the sun.

The panels are briefly described in Table 3 and the maximum moisture content attained in the sheathing bears a more or less definite relation to the resistance to vapor transmission of the vapor barrier. The moisture content of the sheathing was determined by removing previously prepared sections or samples of the sheathing, weighing them, and replacing them in the wall. The weights included any ice present on the inner face of the section at the time of inspection. Generally, it was found that as the ice melted the water soaked into the sheathing with very little change of weight. Before the first weights were taken in the fall the samples were placed in a chamber maintained at constant temperature and humidity and brought to a constant weight or common moisture content of 6 per cent. When replaced in the wall they picked up moisture until they had about 10 per cent which seemed to be the equilibrium moisture content for all panels at that

Table 3—Maximum moisture content in sheathing of wall panels in test house showing effect of various types of vapor barrier

Wall panel	Inner wall	Vapor barrier	Insulation	Sheathing	Sheathing paper	Resistance value in table		Maximum moisture content of sheathing		
						Lath and plaster	Vapor barrier	Top	Bottom	Average
								Per cent	Per cent	Per cent
1-2-3	Gypsum lath and plaster	None	None	3/4-inch wood	50 pounds sheathing paper	13.850	....	16.8	23.1	20.0
4-5-6	Do.	None	4-inch Rock wool	do.	do.	13.850	....	47.5	38.3	42.9
7-8-9	Do.	50-pound coated paper	do.	do.	None	13.850	.364	[1]18.0	13.5	15.8
10-11-12	Do.	Insulation back-up paper	do.	do.	Slater's felt	13.850	1.850	23.2	13.5	18.4
13-14-15	Do.	50-pound coated paper	do.	do.	do.	13.850	.364	12.4	15.3	13.8
16-17-18	Do.	Foil backed lath	do.	do.	do.	13.850	.189	15.0	14.2	14.6
19	Do.	None	4-inch blown Rock wool	do.	do.	13.850	....	30.4	38.9	34.7
22	Do.	Cover sheet	1/2-inch blanket insulation	do.	do.	13.850	1.400	16.0	14.9	15.4
25	Do.	Cover sheet	2-inch blanket insulation	do.	do.	13.850	1.168	16.7	16.3	16.5
26	Fiberboard lath, gypsum plaster	None	4-inch Rock wool	3/4-inch fiberboard	do.	14.800	....	29.0	[2]13.9	21.4
27	Do.	None	None	do.	do.	14.800	....	18.3	[2]18.8	18.6
28	Do.	None	None	3/4-inch coated fiberboard	do.	14.800	....	25.0	16.2	20.6
29	Do.	None	4-inch Rock wool	do.	do.	14.800	....	56.0	32.6	44.3
30	Coated fiberboard lath and gypsum plaster	Coated lath	do.	do.	do.	....	3.240	18.2	12.6	15.4
31	Gypsum lath and paster	Slater's felt	do.	3/4-inch wood	do.	13.850	9.815	30.4	14.6	22.5
32	Do.	30-30-30 Duplex	do.	do.	do.	13.850	1.012	15.3	11.2	13.2
33	Do.	30-50-30 Duplex	do.	do.	do.	13.850	.512	13.6	10.6	12.1
34	Do.	Duplex sheet, 30-90-30 reinforced	do.	do.	do.	13.850	1.018	10.8	9.8	10.3
35	Do.	Duplex sheet covered with metal oxides	do.	do.	do.	13.850	1.080	11.1	9.6	10.4
36	Do.	Foil covered kraft	do.	do.	do.	13.850	.110	......	9.8	9.8
37	Do.	One coat aluminum two coats flat paint	do.	do.	do.	13.850	.925	14.4	11.5	13.0
38	Do.	One coat primer and sealer, one coat flat paint	do.	do.	do.	13.850	1.074	17.9	10.7	14.3
39	Do.	Two coats lead and oil paint	do.	do.	do.	13.850	1.870	21.3	12.3	16.8

[1] Average raised by one sample subject to a leak between panels. Other two samples average 15 per cent moisture content.

[2] Vapor resistance of this sheathing so low that vapor passed through it and gathered back of and in siding where it was not measured as a part of this record. Paint blisters were particularly bad on the siding over these panels.

time of year. Sometime later the outside temperature dropped to an average of about 35 deg and at once the unprotected samples picked up moisture rapidly and the protected samples slowly. The moisture content continued to pick up in all samples as the weather continued to get colder. The protected samples practically reached their maximum content early in January and there was very little change during a severe cold weather period that followed late in January and in February. Apparently the inflow of vapor exceeds the outflow until some vapor pressure head is established, after which the outflow equals the inflow until, when outdoor temperatures averaged 40 deg or higher, the outflow exceeds the inflow and the moisture content tends to drop until it reaches about 10 per cent. The maximum moisture content reached appears to be related to the degree of resistance of the vapor barrier, being lowest in the case of the more resistive barriers.

From the information at hand it appears that for a satisfactory vapor barrier the maximum allowable transmission value for any individual piece should not exceed one grain per hour per square foot on a basis of the vapor pressure difference used in the foregoing tests. Since individual pieces vary in vapor transmission, the average value for a test lot of samples would be less than one grain per hour. Specifications for acceptable vapor barriers might be expressed in either of two ways: (1) the maximum allowable transmission rate per square foot per hour for any individual sample of a test lot or (2) an average value that would be low enough to assure that individual pieces would fall below the maximum allowable rate of transmission. For (1) the maximum transmission value could be established as one grain per hour per square foot and (2) an average of 0.600 grain per hour would be reasonable assurance that individual pieces would fall within acceptable ranges. Test material should be representative of the product as prepared for shipment. For example, types of insulation having attached vapor barrier should have test samples stripped from the insulation after the product has been prepared for shipment. Blanket types that are shipped in rolls should have samples taken from near the center of the roll. Other types of rolled material should have samples taken from the center of the roll or where the sharpest bends occur.

The unprotected samples did not show a tendency to equalize but continued to increase in moisture content as long as the temperature was below freezing but late in March there was a sharp rise to above 40 deg when they started to lose moisture and this loss continued as the outdoor temperatures continued to rise during April and May. It was nearly the middle of June, however, before the samples having the highest winter moisture content reached about 10 per cent, which appeared to be the summer equilibrium condition.

For comparative purposes 15 per cent has been arbitrarily selected as the maximum moisture content for sheathing and vapor barriers that can consistently hold the moisture content at or below this value may be considered satisfactory. This moisture content has been chosen as representing the condition of well air-dried material, and limits the seasonal moisture change to about 5 per cent. (The summer minimum is about 10 per cent moisture content, as explained previously.) Moreover, it allows a factor of safety to take care of minor leakage and breaks in the barrier.

It appears that the barriers having a resistance of about one grain per hour will hold the moisture content of the sheathing at or below 15 per cent moisture content. Some of the barriers in this class, for example the 30-30-30 duplex, represent materials that vary widely in resistance. Specifically it would seem acceptable to admit a material having a known average resistance equal to one grain per hour on a basis of the laboratory method of test. This would admit a 30-30-30 grade duplex of one company and exclude that of another.

Paint coatings on plaster may be very effective as moisture barriers if materials are properly chosen and applied. Of these, aluminum primers, one or two coats, followed by two decorative coats of flat paint or lead and oil seem to offer the best resistance. Primer and sealer paint on the plaster followed by decorative finish coats offers fair resistance and may be satisfactory in older houses though it is below the standard desired in new houses. The plaster finish on the test walls and test samples was smooth. A rough or sand finish plaster might not have so high a vapor resistance with the same types of paint coatings as did the smooth finish.

General Conclusions

The importance of vapor barriers in reducing moisture accumulation in walls is shown in Table 3. Even the unprotected and uninsulated wall panels 1-2-3 need protection but when insulated and unprotected, as in panels 4-5-6, the moisture content of the sheathing reaches a very high point. The same condition appears in the walls having fiberboard insulation. From results in the test walls and in field observations it is apparent that walls having fiberboard sheathing, whether coated or uncoated, should be protected by vapor barriers.

A variety of available materials is suitable for use as vapor barriers. For buildings under construction, the barrier may be one of the asphalt-coated papers, duplex papers, foil-backed lath, suitably coated fiberboard lath, or a high resistance back-up paper on the insulation. For buildings after completion the barriers are generally limited to surface paint coatings.

For dry wall construction, where plywood, fiberboard, or other wall materials are used in place of plaster, paint coatings may be applied to the back or to the face. Asphalt paint coatings on the back of plywood, for example, make an excellent vapor barrier. Two coats, or enough to make a bright shiny surface, are required.

Since vapor barriers are not 100 per cent resistant to vapor movement, exterior wall materials should be permeable to vapor. This condition exists with all usual side-wall materials such as wood, brick, stone, concrete, stucco, and the like. Any sheathing paper used should be permeable to vapor but water resistant and this requirement is met with slater's felt or tar paper. On the other hand, asphalt-saturated felts are several times as resistive as the tar felts and should not be used as a sheathing paper where material of low vapor resistance is required. Many roofing materials are very excellent vapor barriers, particularly asphalt shingles, roll roofing, tin roofs, and composition roofs. To eliminate any moisture that works through the ceiling vapor barrier into the attic or roof space, some form of ventilation should be provided in the attic or roof space above the insulation to allow the escape of the moisture. This ventilation should be from the outside and there should be no free openings into the attic or roof space from the heated portions of the house during cold weather.

NEW POST FOR E. R. GAULEY

E. R. Gauley, Toronto, a member of the Board of Governors of the Ontario Chapter, has been appointed Deputy Administrator of Plumbing, Heating and Air Conditioning Supplies under E. J. Laidlaw, Administrator in the Wartime Prices and Trade Board, Ottawa. He started his new duties on November 2, 1942. Mr. Gauley is on leave of absence from the MacLean Publishing Co., Ltd., Toronto, where he was manager of the two publications, Plant Administration and Sanitary Engineer.

E. R. Gauley

For many years Mr. Gauley has been one of the most active members of the Ontario Chapter and while his many friends in the Chapter are glad to see this well deserved recognition, he will be greatly missed at both Chapter and Board of Governors meetings.

HUMPHREYS APPOINTED ACTING DIRECTOR

The appointment of Clark M. Humphreys as Acting Director of the ASHVE Research Laboratory was approved by the Council at its November 1 meeting in Washington, D. C. Professor Humphreys will continue to teach mechanical engineering at Carnegie Institute of Technology and at the same time actively direct the research program at the laboratory. He graduated from Ohio State University in 1925 and for six years was an engineer in the office of the State Architect in Columbus, Ohio. He served as a member of the ASHVE Council from 1936-1938 and in 1942 was chairman of the Guide Publication Committee.

TRIFLES ARE TREMENDOUS IN WAR

U. S. Army Ordnance Department has recently issued two booklets entitled Tremendous Trifles and Metalurgency. The purpose of these pamphlets is to encourage suggestions on the part of all engineers and production men which will assist in the improvement of ordnance designs and save several critical materials.

Major General L. H. Campbell, Jr., Chief of Ordnance, in a foreword reminds everyone that our war job is far from done and requires more intensive activity. A series of drawings shows 15 examples of savings in critical materials, machine hours and time and money which indicates how every trifle becomes tremendous. An explanation of the progress in the conservation of alloy steels is given and some new manufacturing and heat treating methods are outlined.

For further information about these booklets, address Major General T. J. Hayes, Ordnance Department, U. S. Army, Pentagon Building, Washington, D. C.

Operation of the Research Home with Reduced Room Temperatures at Night

By A. P. Kratz,* W. S. Harris,† and M. K. Fahnestock‡
Urbana, Ill.

SUMMARY—The results of tests made during the 1941-42 heating season on the one-pipe forced-circulation hot-water heating system in the Research Home are presented in this paper. Data are included showing the fuel and power savings effected, and the room temperature conditions obtained, when operating with reduced indoor temperatures at night. A discussion of the variations in the temperature of the water at the outlet and inlet connections of the boiler during the entire warming-up period in the morning is also presented

IN THE BROADEST sense the object of the investigation in the Research Home[1] is to study, under actual service conditions, the different types of steam and hot-water heating systems, and various changes therein, from the standpoints of the systems and their component parts and the environment produced within the building. The specific object of the tests discussed in this paper was to determine the fuel and power savings and room temperature conditions resulting from operating with reduced indoor temperatures at night.

Description of Research Home and Heating System

The Research Home and heating system have been described in a previous paper.[2] The Research Home is a two-story building typical of the small, well-built American home. The construction is brick veneer on frame, and all of the outside walls and the second story ceiling are insulated with mineral wool bats 3⅝ in. thick. All windows and outside doors are weather stripped, and during the past two winters two storm doors were used. The calculated coefficient of heat transmission, *U*, for the wall section is 0.074 Btu per square foot per hour per degree Fahrenheit, and the calculated heat loss under design conditions for the house, excluding the basement, is 43,370 Btu per hour with temperatures of —10 F outdoors and 70 F indoors. The total floor area of the heated space is 1,174 sq ft and the volume is 9,393 cu ft. The house was completely equipped with thermocouples, recording thermometers, humidity indicators and recorders, and all other instruments necessary in making observations on tests.

The heating plant consisted of a one-pipe, forced-circulation, hot-water system, installed in connection with a three-section, cast-iron, oil-burning boiler, having a net I = B = R rating of 63,000 Btu per hour. In open recesses below the windows 261 sq ft of small-tube type, 19-in., 4-tube, cast-iron radiators were used. Based on a heat transmission rate of 200 Btu per square foot per hour, with a mean water temperature of 195 F, and an allowance for recessing, this was just sufficient to offset the calculated heat loss from the house.

Method of Testing

During all tests reported in this paper the operation of the heating plant was controlled by a heat anticipating thermostat located 30 in. above the floor in the living room. An oil burning rate of 1.1 gal per hour was used. This rate was the minimum obtainable with a clean fire and with a CO_2 content of the flue gases of not less than 8 per cent at the smoke outlet of the boiler. The oil used weighed 7 lb per gallon and had a calorific value of 19,550 Btu per pound.

The doors between rooms were open at all times. At 7:00 a.m., 11:00 a.m., 3:00 p.m. and 7:00 p.m. observations were recorded of the room air temperatures as determined by the thermocouples located 3 in., 30 in., and 60 in. above the floor and 3 in. below the ceiling. Complete daily records were made of the operating time, the number

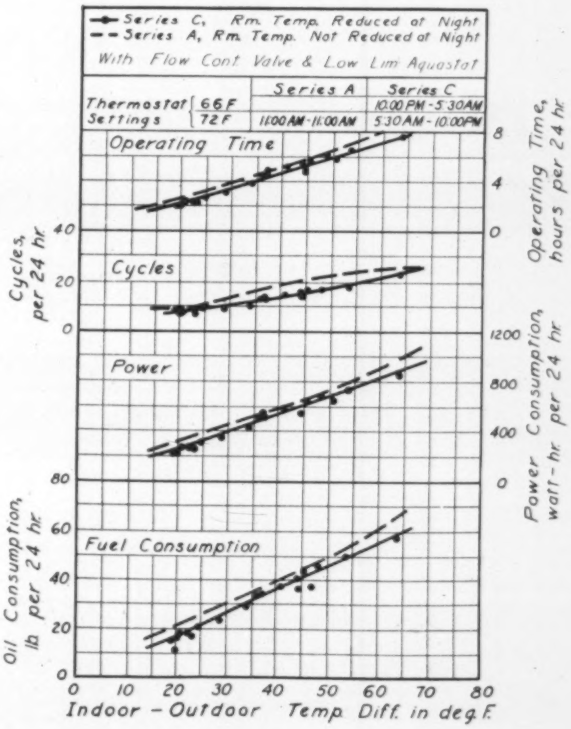

Fig. 1—Burner performance curves, series A and C

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[1] The I-B-R Research Home in Urbana, Ill., was built, furnished, and completely equipped for research work in steam and hot-water heating by the Institute of Boiler and Radiator Manufacturers in 1940.

[2] Performance of a Hot-Water Heating System in the Research Home, by A. P. Kratz, M. K. Fahnestock, W. S. Harris, and R. J. Martin (ASHVE Journal Section, Heating, Piping & Air Conditioning, December, 1941)

For presentation at the 49th Annual Meeting of the American Society of Heating and Ventilating Engineers, Cincinnati, Ohio, January, 1943.

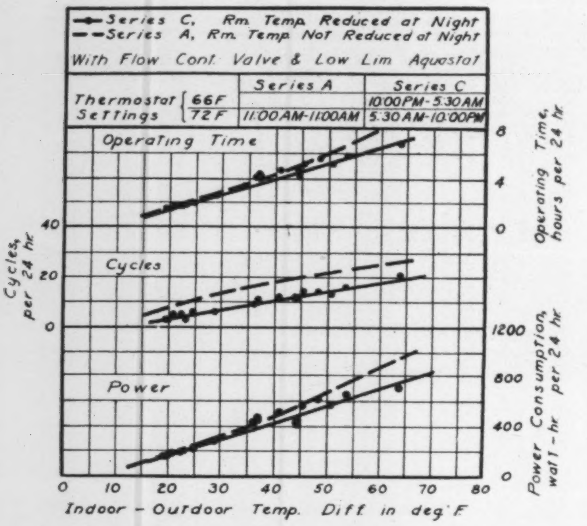

Fig. 2—Circulator performance curves, series A and C

of cycles and the power consumption of the oil burner and circulator, and of the weight of oil consumed. Recording instruments made continuous records of the stack temperature and draft, the CO_2, the temperature of the water at the boiler outlet and return, the outdoor air temperature, the indoor relative humidity, and the air temperature in each room 3 in. and 30 in. above the floor and 3 in. below the ceiling. Other daily observations included the total amount of electricity, gas and water used in the house, the number of occupants, and general weather conditions.

The heating system was arranged so that it could be operated either with or without a flow control valve and low limit aquastat. With the flow control valve in the system the water was circulated at a rate of about 13 gal per minute while the circulator was in operation. When the circulator was not in operation, the flow control valve prevented any circulation of water taking place between the boiler and the radiators. Without the flow control valve in the system, the water was circulated at the same rate while the circulator was in operation; but when the circulator was not in operation some circulation of water could occur by gravity action. In all cases the operation of the circulator was controlled by the room thermostat.

In order to determine whether the same amount of fuel saving could be effected by reducing the indoor temperature at night with each of these two methods of operation, a total of four series of tests was run. Two of these series, *A* and *B*, were run during the heating season of 1940-41 and the results have been discussed in a previous paper.[3] Two additional series, *C* and *D*, were run during the heating season of 1941-42. The test conditions for the different series as related to the setting of the thermostat and the status of the flow control valve and low limit aquastat are given in Table 1.

Results of Tests

Fuel Consumption and Operating Cycles. Curves comparing the burner performance for series *A* in which the house was maintained at a uniform temperature of 72 F 24 hr per day, and series *C*, in which the setting of the thermostat was reduced to 66 F at 10:00 p.m. and the thermostat was reset to 72 F at 5:30 a.m., are shown in Fig. 1. With a given average outdoor temperature over a period of 24 hr, any saving in fuel consumption resulting from reducing the thermostat setting at night is brought about by the fact that the average indoor temperature, and therefore the average indoor-outdoor temperature difference is reduced as compared with that obtained when the room air temperature is maintained at 72 F for 24 hr. With a given heating system and house, the average indoor-outdoor temperature difference for the 24 hr determines the hea loss from the house irrespective as to whether this difference was obtained with a constant indoor temperature for the 24 hr as in series *A*, or with a variable one as in series *C*. Hence these two series cannot be compared on the basis of a 24-hr average for the indoor-outdoor temperature difference as applied to both series, because at a given difference the same fuel consumption would probably be obtained, and the result would be one curve instead of two. In order to determine the fuel saving, it was necessary to make comparisons for days that had the same average outdoor temperature over the 24 hr, with the further condition that the same indoor temperature was maintained during the daytime for both series of tests. These conditions were satisfied by basing the indoor-outdoor temperature differences for series *C* and *D* on the average indoor temperature between 11:00 a.m. and 10:00 p.m. and the average outdoor temperature for 24 hr, and for series *A* and *B* on the 24-hr averages for both the indoor and outdoor temperatures. All of the curves in Figs. 1 to 4 inclusive have therefore been plotted on this basis.

For both series *A* and *C* the heating system was equipped with a low limit aquastat and flow control valve. Operation with the thermostat setting lowered to 66 F at

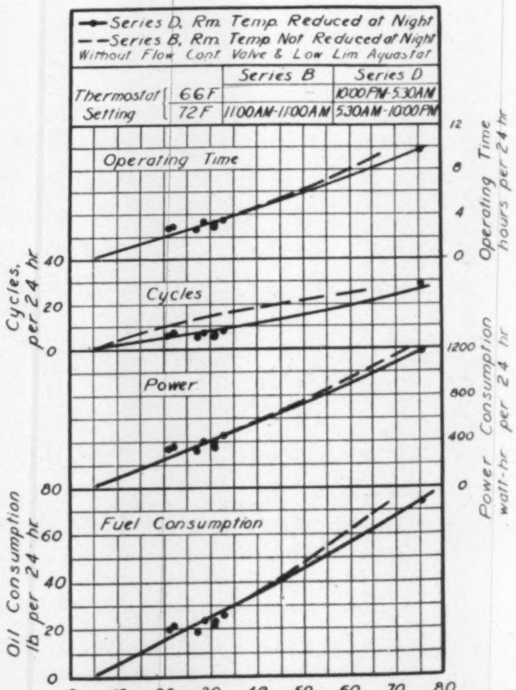

Fig. 3—Burner performance curves, series B and D

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[3] Loc. Cit. Note 2.

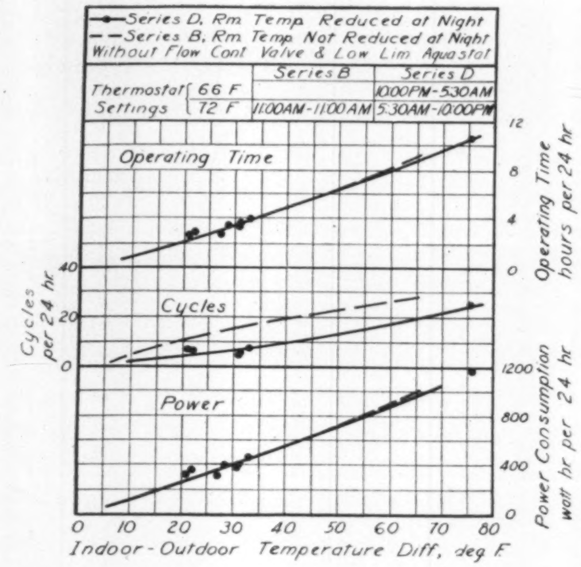

Fig. 4—Circulator performance curves, series B and D

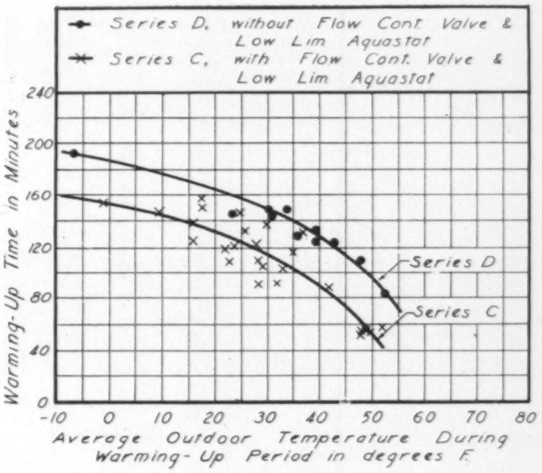

Fig. 5—Time required for morning warming-up period

night resulted in reductions in the burner operating time, cycles of burner operation, burner power, and fuel consumption throughout the complete range of outdoor temperatures occurring during the tests. Savings effected at an indoor-outdoor temperature difference of 34 F are approximately representative of seasonal savings. At an indoor-outdoor temperature difference of 34 F the actual saving in fuel amounted to 10.4 per cent.

At any given indoor-outdoor temperature difference occurring within the range of weather conditions encountered, fewer cycles of burner operation were obtained in series *C* than in series *A*. The greatest difference in the number of cycles accompanied temperature differences of from 40 to 50 F. With temperature differences of less than 40 F the rate of cooling of the air in the house was such that the thermostat would operate the burner not more than once or twice during the night. When the indoor-outdoor temperature difference was greater than 50 F the rate of cooling increased and sufficient time was required to raise the air temperature to 72 F in the morning, so that the high limit aquastat caused the burner to cycle several times. As a result, the number of burner cycles in series *C* approached that obtained in series *A* as the indoor-outdoor temperature difference became greater than 50 F.

Fig. 2 shows the circulator performance curves for series *A* and *C*, plotted on the same basis as the burner performance curves in Fig. 1. At a 34 F indoor-outdoor temperature difference the operating time of the circulator was 5.5 per cent less for series *C* than it was for series *A*. The curves in Figs. 1 and 2 indicate that, as the indoor-outdoor temperature difference increased, an increase in the percentage of fuel saving and circulator and burner operating time occurred.

Operating under the conditions of series *C* resulted in a slightly greater reduction in the number of cycles of operation for the circulator than for the oil burner. By comparing the curves representing the burner and circulator cycles for series *C*, in Figs. 1 and 2, it may may be observed that at all indoor-outdoor temperature differences two or three more cycles of operation were obtained for the burner than for the circulator. During the night, in order to keep the temperature of the water in the boiler above that corresponding to the setting of the low limit aquastat, several operations of the burner were required at low indoor-outdoor temperature differences, while no operation of the circulator was necessary. On the other hand, at high temperature differences, the time required in the morning to raise the indoor temperature from 66 F to 72 F was sufficient to allow the burner to cycle several times by action of the high limit aquastat. During this time, since the circulator was controlled only by the room thermostat, it operated continuously.

Comparisons of the burner and circulator performances obtained for series *B* with those obtained for series *D* are shown in Figs. 3 and 4. During both of these series the heating system was operated without the flow control valve and low limit aquastat, and for series *D* the setting of the room thermostat was reduced at night.

The curves show that at, and below, an indoor-outdoor temperature difference of 34 F, reducing the indoor temperature at night resulted in no saving in the fuel used, or in the operating time and power consumption for the burner and circulator. The fuel saving indicated at an indoor-outdoor temperature difference of 34 F is only approximately representative of seasonal savings and since the curves do indicate some savings at indoor-outdoor temperature differences greater than 45 F, it is reasonable to assume that some seasonal saving would be effected. However, since only a relatively small portion of

Table 1—Test Conditions

Thermostat	With Flow Control Valve[a] and Low Limit Aquastat	Without Flow Control Valve and Low Limit Aquastat
Set at 72 F during 24 hours	Series *A*	Series *B*
Set to 66 F at 10:00 p.m. and to 72 F at 5:30 a.m.	Series *C*	Series *D*

[a] Low limit aquastat set for minimum temperature of 165 F.

the total heating season is represented by indoor-outdoor temperature differences greater than 45 F, it is also evident that in the case of operation without the flow control valve and low limit aquastat in the system no material seasonal saving resulted when the indoor temperature was reduced at night. On the other hand, over the whole range of indoor-outdoor temperature differences, a reduction in the number of operating cycles for both the burner and circulator was obtained. This reduction was approximately the same as that exhibited by the results for series *C* as compared with those for series *A*.

Over the whole range of outdoor temperatures, the time required to raise the average house temperature from 66 F to 72 F as shown in Fig. 5, was approximately 30 min less in series *C* than it was in series *D*. In the discussion in the section on Water Temperatures it is shown that this reduction of 30 min in the time for warming up in the morning is a direct result of the additional heat stored in the water in the boiler when operating the system with a flow control valve and low limit aquastat. The additional 30 min of operation during the warming-up period in series *D* was almost equal to the difference in total saving in burner operating time resulting from the reduction of indoor temperature at night in series *C* as compared with series *D*, and was sufficient to account for the fact that the saving effected in series *D* was less than that effected in series *C*. At an average indoor-outdoor temperature difference of 34 F, the burner operating time and fuel consumption were approximately the same in series *B*, *C* and *D*.

Water Temperatures: When the thermostat setting was reduced at night there was always a long off-period following the time at which the change was made. With the flow control valve in the system, series *C*, the water in the radiators and uninsulated piping cooled to room temperature during this long off-period, while that in the boiler cooled at an average rate of about 10 F per hour until the temperature was approximately 165 F at the location of the low limit aquastat. When this occurred, the burner operated for a sufficient length of time to raise the temperature of the water in the boiler to approximately 175 F.

When operating without the flow control valve in series *D*, the water in the entire system cooled to room temperature during the long off-period following the reduction of the thermostat setting. The rate at which the air in the house cooled at night was such that, for the average winter day, the thermostat would not start the burner during the entire period of from 10:00 p.m. to 5:30 a.m. Under these conditions, in both series *C* and *D*, at the start of the morning warming-up cycle the temperature of the water in the radiators and piping was about the same as the indoor air temperature. In series *D* the water in the boiler had also cooled to room temperature, while in series *C* it could never cool below approximately 165 F.

For both methods of operation, with and without flow control valve and low limit aquastat, the curves in Fig. 6 show the variations in temperature of the water at the outlet and inlet connections of the boiler during the entire warming-up period occurring after the thermostat had been reset to 72 F. The outdoor temperature was approximately 42 F at 6:00 a.m. in both cases. The effect of the presence of the hot water in the boiler at the start of the warming-up period in series *C* is shown by the full line curves. The temperature of the water at the boiler outlet was 158 F during the first 4 min of the period, after which it dropped rapidly to about 108 F and then gradually increased until it attained a value of 203 F at the end of 85 min. At this time the indoor air temperature reached 72 F, and the room thermostat stopped both the burner and the circulator. For series *D*, when the outdoor temperature was 42 F, the temperature of the water at the boiler outlet, represented by the upper broken line, was only 68 F at the start of the warming-up period. This temperature steadily increased until it reached 204 F at 97 min after the start of the period. At this time the high limit aquastat stopped the burner, but not the circulator. The outlet water then cooled to 180 F, at which time the burner was restarted and continued to operate for the remainder of the warming up period. In series *D* the time required to raise the indoor air temperature to 72 F was 121 min, or 36 min longer than that required

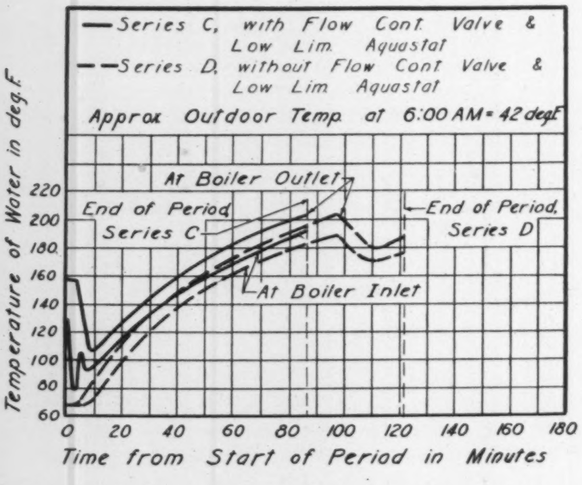

Fig. 6—Boiler water temperature during morning warming-up period

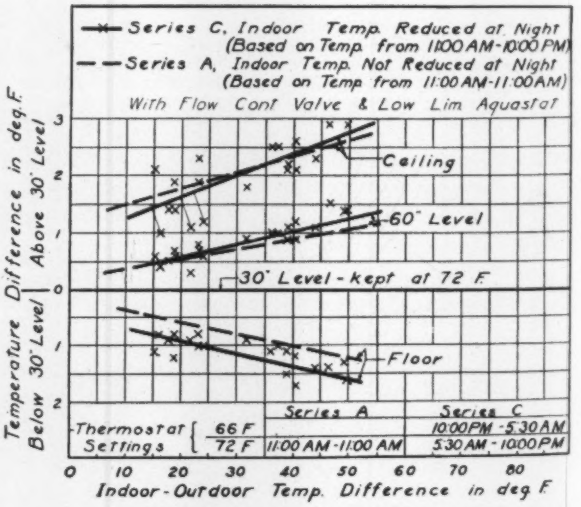

Fig. 7—Indoor air temperature differentials

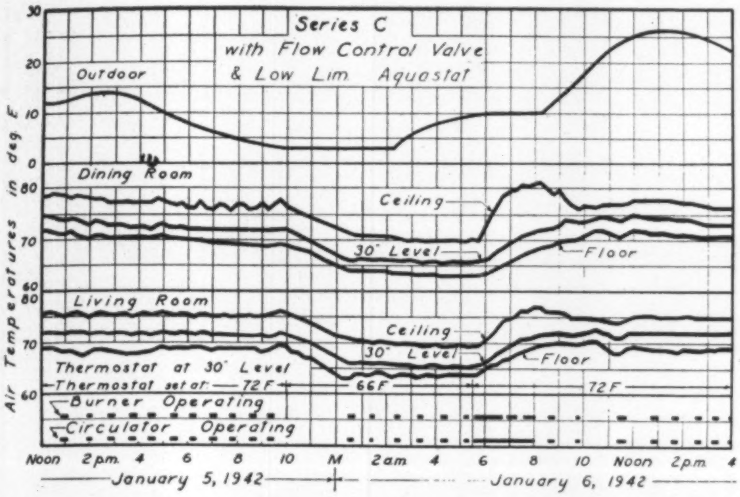

Fig. 8—Graphic log for operation with reduced indoor temperatures at night

with operation on series *C* at the same outdoor temperature.

Over the total time of the warming-up period the heat released in the house by the radiators and piping is directly proportional to the area between the inlet and outlet boiler water temperature curves. Since the rate of circulation of the water through the heating system during the on-periods of the circulator was the same in both series, the proportionality factor would also be the same, and the heat releases for the two series can be directly compared by comparing areas included between the respective inlet and outlet temperature curves. Over the total time included in the warming-up period for each series, there is less than 2 per cent difference between the total areas obtained from the inlet and outlet water temperature curves representing series *C* and those representing series *D*. This indicates that, at a given outdoor temperature, the same quantity of heat was supplied to the house during the warming-up period by both methods of operation. However, in series *D* not only the water in the radiator and piping, but also the boiler castings, refractories and the water in the boiler cooled to room temperature at night. As a result, during the additional 36 min required to bring the air temperature to 72 F, the burner operated 22 min in order to supply the extra heat necessary to bring the boiler castings, refractories and the water in the boiler back to normal temperature in the morning. Since, at a given outdoor temperature, the same amount of heat was supplied to the house during the warming-up period for both series *C* and *D*, but 22 min more of burner operation were required for series *D* than for series *C*, it seems evident that a lower overall efficiency was obtained in series *D* than in series *C*. Part of the heat represented by the 22 min of additional burner operation was used to bring the boiler castings, refractories, and the water in the boiler back to normal temperature, and the remainder appeared as increased chimney losses resulting from the higher flue gas temperatures accompanying the longer period of burner operation occurring in series *D*.

Room Temperature Gradients. The indoor air temperature differentials obtained with series *C*, operating with reduced indoor air temperature at night, and series *A*, operating with a constant indoor air temperature of 72 F maintained for 24 hours, are shown in Fig. 7. The temperature differentials were based on the averages of the temperatures in all of the rooms.

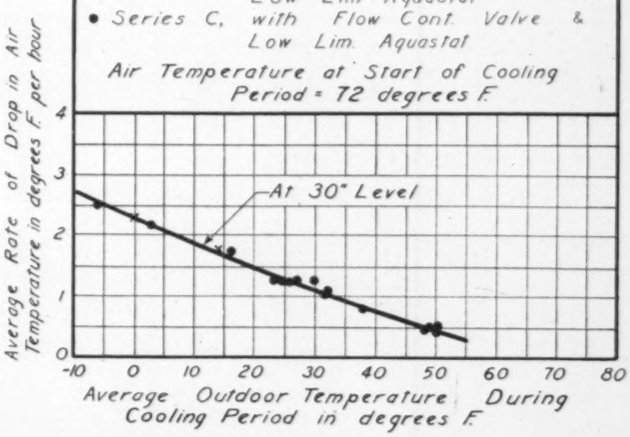

Fig. 9 — Rate of cooling of living room

For the purpose of determining whether the reduction in indoor temperature at night and the subsequent morning pick-up in series *C* had any effect on the indoor air temperature differentials obtained with normal day-time operation, only the temperatures prevailing during the period over which the house was maintained at 72 F were considered as having any significance. Hence, for series *C* in Fig. 7, the room temperature differentials obtained from the average indoor temperatures from 11:00 a.m. to 10:00 p.m. for a given day were plotted against the indoor-outdoor temperature difference obtained by subtracting the average temperature at the 30-in. level between the hours of 11:00 a.m. and 10:00 p.m. from the average outdoor temperature for the 24 hours. From Fig. 7 it may be observed that the reduction in the indoor temperature at night in series *C* had no significant effect on the indoor air temperature differentials.

At all indoor-outdoor temperature differences the temperature at the floor was about 0.3 F lower in series *C* than in series *A*. Between the running of series *A* and *C*, two sections were added to one of the radiators in the living room and five sections were removed from the radiator in the SW bedroom. After these changes were made in the plant, a few check tests, run under the conditions of series *A*, indicated that the slight change in the temperature of the air at the floor should be attributed to causes other than any effect resulting from the reduction in room air temperature at night. The curves shown in

Fig. 7 also proved to be characteristic of the operation without the flow control valve and low limit aquastat in series *B* and *D*.

A typical graphic log showing air temperature variations and times of burner and circulator operation in the Research Home when operating with reduced indoor temperatures at night is presented in Fig. 8. At 10:00 p.m. the thermostat was set at 66 F. From 10:00 p.m. to 12:30 a.m. neither the burner nor the circulator operated, while the air temperature at the 30-in. level decreased from 72 F to 66 F. From 12:30 a.m. to 5:30 a.m. the burner and circulator operated intermittently to maintain the air temperature at 66 F. At the latter time the thermostat was set at 72 F, and the burner and circulator started. The circulator operated continuously for 2.5 hours, during which time the house temperature increased from 66 F to 72 F. In the course of this 2.5 hour warming-up period the oil burner operated continuously for the first 75 min, and the temperature of the water in the system increased until the high limit aquastat stopped the burner. In about 10 min the water cooled enough to permit the aquastat to again start the burner, after which, under control of the high limit aquastat, the burner operated intermittently until the end of the 2.5 hour warming-up period.

The air temperatures for both the dining room and the living room have been included in Fig. 8 since the overruns in temperature obtained in these two rooms during the warming-up period were the maximum and minimum observed in any of the rooms of the house. At the end of the warming-up period at 8:00 a.m., the temperature at the 30-in. level did not exceed 72 F in either the dining room or living room. On the other hand, the temperature 3 in. below the ceiling in the dining room reached a maximum of 81 F while that in the living room attained a maximum of only 77 F. At the same time the temperature of the air 3 in. above the floor in the dining room was 68 F and that in the living room was 69 F. Thus it is evident that, while some overrun was exhibited in the temperature of the air 3 in. below the ceiling when the burner and circulator were stopped at the end of the warming-up period, no overrun in temperature occurred at the control level, 30 in. above the floor.

After the warming-up period, the natural circulation of air tended to equalize the temperatures at the different levels, decreasing the temperature of the air at the ceiling and slightly increasing that at the floor and control levels, so that by about 10:00 a.m. the normal temperature differentials had been established in the rooms. Similar records to those shown in Fig. 8 were made of the temperature variations in each room of the house. These records indicated that there was a rough correlation between the amount of overrun in the temperature of the air near the ceiling and the ratio of the room volume to the amount of radiation installed. As this ratio increased, the amount of overrun decreased.

After changing the setting of the thermostat from 72 F to 66 F at night, the rate at which the temperature of the air in the rooms dropped was primarily dependent upon the outdoor temperature prevailing during the cooling period. The average rate of temperature drop for the living room, which is also representative of that for the house as a whole, is shown in Fig. 9. An indoor temperature of 66 F was never attained during the 7.5 hours between 10:00 p.m. and 5:30 a.m. unless the average cooling rate was equal to or greater than $\frac{6}{7.5}$, or 0.8 F per hour. From Fig. 9 it may be observed that this occurred only when the average outdoor temperature at night was 39.5 F or less. It is therefore evident that at outdoor temperatures above 39.5 F, setting the thermostat back more than 6 F would not result in any additional saving in fuel over that which could be obtained by the 6 F setback.

The cooling rate is a function of house construction and the indoor-outdoor temperature difference, and the total fuel saving that can be effected by operating with reduced indoor air temperatures at night is largely a function of three factors: (1) The number of degrees the thermostat is set back at night. (2) The number of hours of operation on reduced temperature at night, and (3) the rate at which the house cools. Taking into consideration the length of time required to warm the house in the morning and the time required to overcome the effect of cold walls and furniture, it is probable that, except in the most severe climates, the practical limits for night setback of the thermostat lie somewhere between 6 and 10 F.[4]

Summary

The following is a summary of the results obtained in this investigation:

(1) By setting the thermostat to 66 F at 10:00 p.m. and restoring the setting to 72 F at 5:30 a.m. a saving of approximately 10 per cent was effected in the seasonal fuel consumption and burner operating time, and approximately 5.5 per cent saving in circulator operating time, when operating the system with a flow control valve and low limit aquastat maintaining a minimum boiler water temperature of 165 F.

(2) Only a slight saving in seasonal fuel consumption, burner operating time and circulator operating time was effected when the thermostat was set back at night and the system was operated without a flow control valve and low limit aquastat. This condition probably resulted from the fact that it required a longer time to warm the house in the morning with this method of operation than that required when operating with a flow control valve and low limit aquastat, and the additional losses during this time tended to offset the possible saving effected by the night set-back.

(3) Exclusive of the warming-up period in the morning, reducing the indoor temperature at night had no effect on the temperature conditions within the house during the day.

(4) While overruns of from 2 to 5 F were observed in the temperature of the air at the ceiling during the morning warming-up periods, no such overruns occurred at the control level 30 in. above the floor.

(5) In average winter weather the indoor air cooled not more than 6 F during the 7.5 hours that the thermostat was set back at night.

Acknowledgments

The results presented in this paper were obtained in connection with the investigation of steam and hot water heating systems in the Research Home at the University of Illinois, conducted by the Engineering Experiment Station, of which M. L. Enger, Dean of the

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[4] Investigation of Oil-Fired Forced-Air Furnace Systems in the Research Residence, University of Illinois Engineering Experiment Station Bulletin 318, pp. 49-57.

College of Engineering, is director, and in the Department of Mechanical Engineering of which O. A. Leutwiler, Professor of Mechanical Engineering Design, is the head. This investigation is a cooperative project sponsored jointly by the Institute of Boiler and Radiator Manufacturers and the Engineering Experiment Station. These results will ultimately comprise part of a bulletin of the Engineering Experiment Station. Acknowledgment is hereby made to R. J. Martin, formerly Special Research Assistant, for services rendered in collecting and reducing test data. Acknowledgment is also made to the various manufacturers who cooperated by furnishing materials and equipment.

NEW RESEARCH PROBLEM FOR OREGON STATE

Investigation of the heat flow through wet building walls is being sponsored by the ASHVE at Oregon State College, Corvallis, according to a joint announcement of F. C. McIntosh, Pittsburgh, Pa., Chairman of the Committee on Research of the Society, and Dean R. H. Dearborn of the School of Engineering.

The research program will be carried out under the cooperative agreement at the domestic heating laboratory of the College at Corvallis by means of a specially constructed apparatus in a study jointly planned by Prof. Earl C. Willey of the College and the research committee of the Oregon Chapter of the Society, of which Edwin W. Neubauer of Portland is chairman. Various types of building wall sections will be constructed and tested under conditions simulating heat loss during rainy weather.

"The results of the investigation," said Mr. Neubauer, "should be of particular interest for application in the Pacific Northwest in which building walls are wet during much of each winter season. Incomplete information on heat loss through wet walls is available at present for accurate determination of heating plant requirements."

The laboratory at the college is part of the Department of Mechanical Engineering in the School of Engineering, of which Prof. S. H. Graf is the head. Professor Willey is in charge of the heating laboratory and will have direct supervision of the project which is part of the research program of the Engineering Experiment Station. The Society's Oregon Chapter, of which Bert W. Farnes of Portland is president, will act in an advisory capacity in connection with this research project, which will be of widespread interest to engineers.

TECHNICAL MEN IN DEMAND

Following recent increases in demand for technically-trained personnel, the National Roster of Scientific and Specialized Personnel, Washington, D. C., urged senior and graduate students of chemistry, physics, engineering, and other specialized fields to register their skills. The principal national professional and scientific societies are constantly cooperating with the National Roster to stimulate complete registration in their respective fields.

The National Roster, a part of the War Manpower Commission, now has listed and punch-card-indexed approximately 550,000 names in more than 60 specialized occupations. The over-all information of the Roster is used as a basis to determine shortages in any technical field and to supply needed professional and scientific personnel for the armed forces, war industry, and Governmental agencies.

To register with the Roster, a man or woman with scientific or other specialized training should write to Dr. Leonard Carmichael, Director, National Roster of Scientific and Specialized Personnel, War Manpower Commission, Washington, D. C., mentioning the field or fields in which he or she has training or knowledge.

BUY
WAR BONDS
AND
STAMPS

ADDITIONAL COLLEGES AND CURRICULA ACCREDITED BY ECPD

Notre Dame and the University of Toledo have been added to the list of United States colleges whose engineering courses have been accredited by the Engineers' Council for Professional Development, consisting of eight engineering societies in the United States and Canada. At Notre Dame, curricula in aeronautical, civil, electrical, mechanical and metallurgical engineering have been accredited; and at Toledo, the course in general engineering. Additional curricula have been inspected and accredited by the Council at 12 other colleges: chemical engineering at Bucknell, Lewisburg, Pa.; mechanical engineering at Catholic University of America, Washington, D. C.; chemical engineering at Cooper Union Night School of Engineering, New York, N. Y.; chemical engineering at the University of Florida, Gainesville; ceramic engineering at Georgia Tech, Atlanta; geological engineering at Idaho, Moscow; chemical engineering at Maryland, College Park; chemical engineering at Northeastern, Boston, Mass.; chemical engineering at Oregon State, Corvallis; aeronautical engineering at Texas A. and M., College Station; civil, electrical and mechanical engineering at Southern California, Los Angeles; and chemical engineering at Worcester Tech, Worcester, Mass.

A total of 577 engineering curricula in 131 colleges and universities in the continental United States have now been accredited by ECPD through the inspection program of its Committee on Engineering Schools in the last decade. Only degree-granting schools are considered.

At the tenth annual meeting of the Council, held recently in New York, R. E. Doherty, president of Carnegie Institute of Technology, was re-elected chairman. Other officers elected are S. D. Kirkpatrick, editor of Chemical and Metallurgical Engineering, vice-chairman; A. B. Parsons, secretary of the American Institute of Mining and Metallurgical Engineers, secretary; S. L. Tyler, executive secretary of the American Institute of Chemical Engineers, assistant secretary.

Summer Comfort Factors as Influenced by the Thermal Properties of Building Materials[†]

By C. O. Mackey* and L. T. Wright, Jr.**, Ithaca, N. Y.

Purpose

THE PURPOSE of this study is to analyze the effects of the thermal properties of wall materials influencing human comfort under typical summer conditions. This study is restricted to the case of a wall of a single layer of homogeneous material.

A complete mathematical solution for the hour-by-hour variation of the temperature of each inside solid surface of a building involves setting up a heat balance for each such surface, and because of the large number of variables, is impractical, particularly when unsteady heat flow is involved. Instead, certain simplifying assumptions are made in this study—assumptions which will not limit the investigation of the general effects of the thermal properties of the wall materials upon comfort.

Method and Results

For the *steady flow* of heat through a building wall, the temperature of the inside surface of the wall is

$$t_o = t_i + \frac{U}{h_o}(t_e - t_i) \quad \ldots\ldots.[1]$$

where t_o = the temperature of the inside surface of the wall, F;
t_i = the dry-bulb temperature of the indoor air, F;
U = the over-all coefficient of heat transfer for steady flow, Btu/(hr) (ft²) (F);

$$= \frac{1}{\frac{1}{h_o} + \frac{1}{h_L} + \frac{L}{k}}$$

h_o = equivalent inside air film coefficient of heat transfer, Btu/(hr) (ft²) (F);
h_L = the outdoor air film coefficient of heat transfer, Btu/(hr) (ft²) (F);
L = the thickness of the wall, ft;
k = the thermal conductivity of the wall material, Btu/(hr) (ft) (F);
t_e = the equivalent temperature of the outdoor air to include solar radiation incident upon wall, F;

$$= t_a + \frac{aI}{h_L};$$

t_a = the dry-bulb temperature of the outdoor air, F;
I = the intensity of solar radiation incident upon the outside surface of the wall, Btu/(hr) (ft²);
a = the absorptivity of the outside wall surface for solar radiation.

Of these terms, all are familiar except the equivalent outdoor air temperature. This is the temperature of the outdoor air which, in contact with a shaded wall, would give the same rate of heat transfer and the same temperature distribution through the wall as exists with the actual outdoor air temperature and incident solar radiation. For example, when the temperature of the outdoor air is 90 F, and the intensity of solar radiation incident upon a wall with an absorptivity of 0.4 is 100 Btu/(hr) (ft²), the equivalent temperature of the outdoor air is

$$\left[90 + \frac{0.4(100)}{4}\right]$$

or 100 F for an outdoor air film coefficient of heat transfer of 4 Btu/(hr) (ft²) (F); in other words, an air temperature of 100 F in contact with a shaded wall is equivalent to the combined effects of actual air temperature and solar radiation.

For the *unsteady flow of heat* through a building wall of a single homogeneous material *with a constant temperature of the indoor air*, the solution presented by Alford, Ryan, and Urban[1] has been checked by the authors and is given here in slightly different form.

Assume a Fourier series for the temperature of the outdoor air of the form:

$$t_a = t_m + t_o\,(\omega_o\Theta - \alpha_o) + t_1\,(\omega_1\Theta - \alpha_1) + \ldots\ldots\ldots\ldots\ldots\ldots\ldots[2]$$

Assume a Fourier series for the solar radiation incident upon the wall of the form:

$$I = I_m + I_o\,(\omega_o\Theta - \beta_o) + I_1\,(\omega_1\Theta - \beta_1) + \ldots\ldots\ldots\ldots\ldots\ldots\ldots[3]$$

The temperature of the inside surface of the wall is

$$t_o = t_i + \frac{\frac{1}{h_o}(t_m - t_i) + \frac{aI_m}{h_o h_L}}{\frac{1}{h_o} + \frac{L}{k} + \frac{1}{h_L}} + \sum \lambda_n\, t_n \cos\,(\omega_n\Theta - \alpha_n - \phi_n)$$
$$+ \sum \frac{\lambda_n\, aI_n}{h_L} \cos\,(\omega_n\Theta - \beta_n - \phi_n) \quad \ldots\ldots\ldots\ldots\ldots\ldots[4]$$

$$\text{where } \lambda_n = \frac{1.414\, h_L\, k\sigma_n}{\sqrt{f_n^2 + g_n^2}} \quad \ldots\ldots\ldots\ldots\ldots\ldots[5]$$

$$\phi_n = tan^{-1}\left(\frac{f_n - g_n}{f_n - g_n}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots[6]$$

$$\sigma_n = \sqrt{\frac{\omega_n \rho c}{2k}} \quad \ldots\ldots\ldots\ldots\ldots\ldots[7]$$

$$f_n = (h_o + h_L)\,k\sigma_n\,(\cos\sigma_n L \cosh\sigma_n L + \sin\sigma_n L \sinh\sigma_n L)$$
$$+ h_o\, h_L \sin\sigma_n L \cosh\sigma_n L + 2k^2 \sigma_n^2 \cos\sigma_n L \sinh\sigma_n L \quad \ldots\ldots[8]$$

$$g_n = (h_o + h_L)\,k\sigma_n\,(\cos\sigma_n L \cosh\sigma_n L - \sin\sigma_n L \sinh\sigma_n L)$$
$$+ h_o\, h_L \cos\sigma_n L \sinh\sigma_n L - 2k^2 \sigma_n^2 \sin\sigma_n L \cosh\sigma_n L) \quad \ldots\ldots[9]$$

[†] This paper is the result of research sponsored by the John B. Pierce Foundation in its program in the field of low-cost housing and a report of complete study will be published by the Foundation.

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**Instructor of Heat-Power Engineering, Cornell University.

[1] Effect of Heat Storage and Variation in Outdoor Temperature and Solar Intensity on Heat Transfer Through Walls, by J. S. Alford, J. E. Ryan and F. O. Urban. (ASHVE Transactions, Vol. 45, 1939.)

For presentation at the 49th annual meeting of American Society of Heating and Ventilating Engineers, Cincinnati, Ohio, January, 1943.

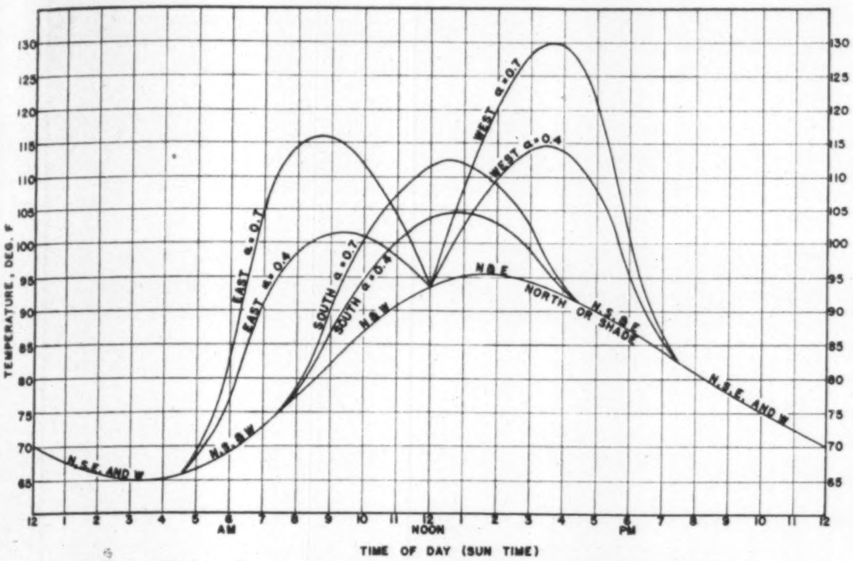


Fig. 1—Equivalent outdoor air temperatures for Figs. 2 and 3

The solution of these equations is involved and a detailed discussion is valueless at this point. The following general conclusions may have some practical value:

1. When the outdoor air temperature and solar radiation incident upon a wall are cyclic with a period of 24 hours, and when cooling equipment is operated within the structure, the total gain of heat through the wall in 24 hours depends only upon the steady flow thermal properties of the wall. All walls with the same ratio of thickness to thermal conductivity, same absorptivity of the outside surface for solar radiation, and the same emissivity of the interior surface will transmit the same quantity of heat daily. The quantity of heat transmitted daily is

$$q = \frac{24\left(t_m + \dfrac{aI_m}{h_L} - t_i\right)}{\dfrac{1}{h_o} + \dfrac{L}{k} + \dfrac{1}{h_L}} \quad .[10]$$

When no cooling equipment is operated within the enclosure, the net daily gain of heat is zero. In this case, the assumed constant temperature of the indoor air must be

$$t_i = t_m + \frac{aI_m}{h_L} \quad ....[11]$$

2. The temperatures of the inside surfaces of the wall will follow markedly different curves, when plotted against time of day, for walls having the same steady flow thermal properties but different thermal conductivities and volumetric specific heats.

In comparing two walls of the same steady flow thermal properties but different thermal conductivities and specific heats, the temperature of the interior surface of one wall will be ***higher*** than that of the other during certain hours of the day but *lower* during the remainder of the day. In other words, it is impossible for one wall which has the same steady flow thermal properties as a second wall to have a lower inside surface temperature than the second wall during the entire 24-hour period.

This result affects the required capacity of the cooling equipment when cooling is used and affects the comfort at a given time of the day when no cooling is provided.

3. The selection of the thickness and thermal properties of the ideal wall is intimately tied to the use of a room at any particular time of day. A room used during the night should have walls of different properties than a room used only during the daylight hours. The practice of building a structure with all walls of the same thickness and thermal properties cannot be justified from thermal considerations alone.

In support of these general conclusions, the authors present a few results from an extended study made for the John B. Pierce Foundation. In Fig. 1 are shown equivalent outdoor air temperatures for the variations of outdoor air temperature and incident solar radiation assumed in this study for North (or shade), East, South, and West walls; three values of absorptivity for solar radiation are included: 0, 0.4, and 0.7. The equivalent temperature curve for zero absorptivity is the curve of outdoor air temperature. In Fig. 2 are shown the hourly variations in the temperatures of the inside surfaces of two walls with substantially the same steady flow thermal properties when exposed to the air and solar conditions of Fig. 1. The thicknesses and thermal properties of the two materials so compared are given in Table 1.

Additional assumptions made in obtaining these results are:

Outdoor air film coefficient of heat transfer = h_L = 4 Btu/(hr) (ft^2) (F);

Solar absorptivity of each exterior surface = a = 0.7;

Constant indoor air temperature = t_i = 80 F;

Rate of heat transfer at inside surface = h_o = 1.5 Btu/(hr) (ft^2) for each degree of difference between the temperature of the inside surface of the wall and 80 F.

A study of these curves shows that the temperature of the inside surface of the cellular glass wall follows a curve similar in shape to that of the equivalent outdoor air temperature (Fig. 1) for any given orientation; due to the low heat storage capacity of this wall, the results are substantially the same as for steady heat flow. The high heat storage capacity of the thick brick wall produces a large time lag and a considerable attenuation of the thermal effects. Although for a given orientation both walls transmit the same net quantity of heat daily (proportional to the area between the curve and the 80 F line), the instantaneous maximum rate of heat transfer from the inside surface of a West wall, for example, is 11.85 Btu/(hr) (ft^2) around 3:45 p.m. for the cellular glass and only 2.79 Btu/(hr) (ft^2) around 2 a.m. for the brick. For the West wall, the minimum rate of heat transfer from the inside surface of the brick wall is 0.42 Btu/(hr) (ft^2) at 3:30 p.m.; for cellular glass West wall at 3:45 a.m. there is a rate of heat transfer *to* the inside wall surface of 4.26 Btu/(hr) (ft^2), which means that *heating*, instead of cooling, would be required during the evening to maintain the as-

Table 1—Properties of the walls compared in Fig. 2

Material	Thickness L ft	Thermal Conductivity k Btu/(hr) (ft) (F)	Thermal Conductance $\frac{k}{L}$ Btu/(hr) (ft^2) (F)	Volumetric Specific Heat ρc Btu/(ft^3) (F)
Cellular Glass	0.125 (1.5 in.)	0.04	0.32	1.71
Brick (low-density) .	1.333 (16 in.)	0.417	0.313	19.9

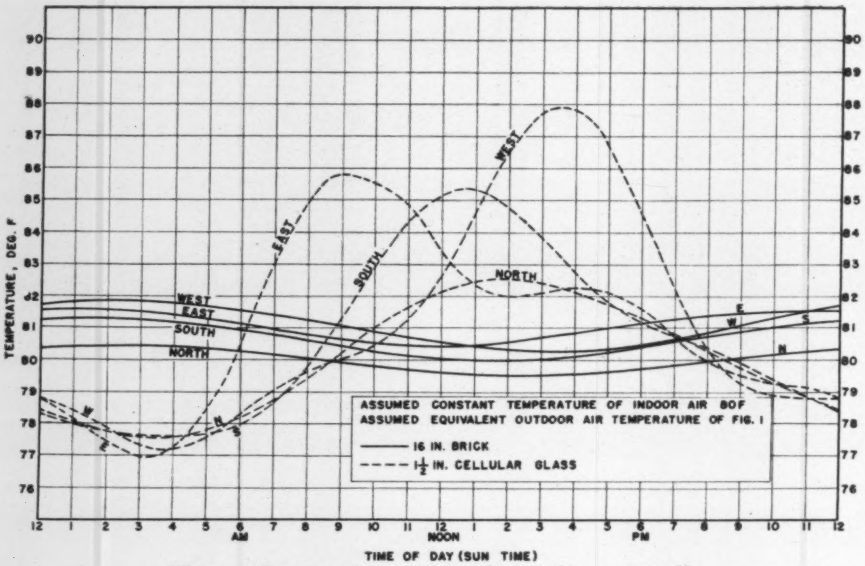


Fig. 2—Temperature of inside surface of wall

sumed constant indoor air temperature of 80 F with this wall. Note also that the cellular glass West wall, for example, gives a *cooler* comfort condition than the brick wall between the hours of 7:45 p.m. and 10:30 a.m. and a *warmer* comfort condition between the hours of 10:30 a.m. and 7:45 p.m., even though the temperature of the indoor air is held constant at 80 F.

For an enclosure which is not air conditioned, it is difficult to derive the complete particulars of the effects of thermal properties of the wall upon comfort from a mathematical solution of a case where the temperature of the indoor air is assumed to remain constant. In a report submitted to the John B. Pierce Foundation, the authors have presented a solution which gives the hourly variation of the temperature of the inside surface of the wall and of the indoor air for a fixed, constant rate of ventilation of the enclosure with outdoor air. The results of this study of unsteady heat flow are too complex for inclusion in this paper. Instead, some general conclusions may be drawn by giving here the results obtained when the indoor air temperature is assumed to remain constant at the mean outdoor equivalent air temperature given by Equation 11. For the different orientations with $a = 0.7$ and $h_L = 4$, these mean temperatures are:

North or shade wall: $t_i = 80$ F
East and West walls: $t_i = 86.58$ F
South wall: $t_i = 84.04$ F

Based upon these assumed values of a constant indoor air temperature, the hourly variations of the temperatures of the inside surfaces of the walls of brick and of cellular glass are shown in Fig. 3. The results for a North wall are not included, since they are the same as those shown in Fig. 2. In the case of the non-cooled enclosure, the temperature of the indoor air is not constant, but since there are many solid surfaces within the room which remain at nearly these mean temperatures throughout the day, and the inside wall surface may lose heat when its temperature is above this mean and gain heat when its temperature is lower than the mean. As a consequence, the results obtained are not wholly fictional.

Realizing that the engineer and architect may gain little useful information from inspecting a solution in the form of Equations 2 through 9, or even from a study of curves for a few specific cases, the next purpose of the paper is to give a simplified solution for this case of unsteady heat flow and to present the final results in the form of a chart which gives a real picture of the effects of thermal properties upon comfort. From a study of many results, it has been found that a reasonably accurate curve of the hourly variation in temperature of the inside surface of a single-layer, homogeneous wall may be quickly found. *First,* draw a curve of *equivalent outdoor air temperature,* like Fig. 1; if the curves assumed here for outdoor air temperature and incident solar radiation do not fit the problem, different ones may be used. *Second,* calculate the *fundamental* time lag (neglect harmonics). For this purpose, use

$$\sigma_o = \sqrt{\frac{0.1309\,\rho c}{k}} \quad \ldots\ldots. [12]$$

Then the fundamental time lag in hours is ϕ_o (the fundamental lag angle from Equation 6) divided by 15. *Third,* calculate the fundamental equivalent thermal resistance ratio, λ_o, from Equation 5. Then, begin with any temperature (t_{e1})

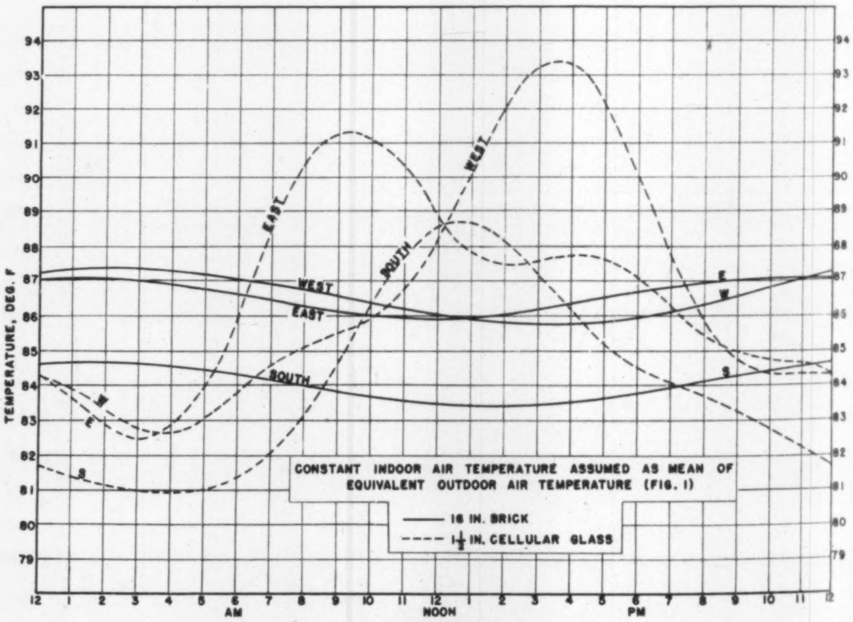
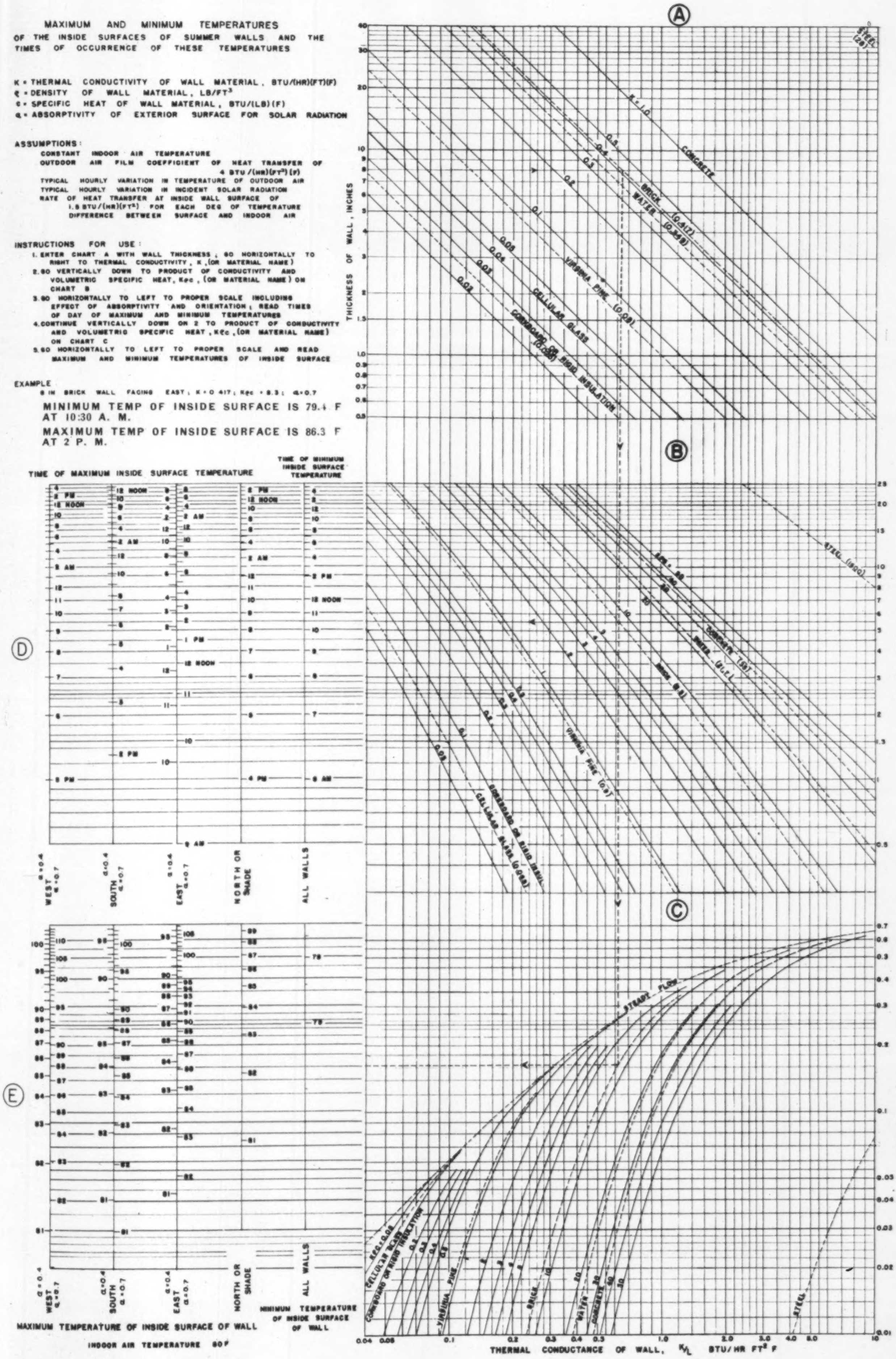


Fig. 3—Temperature of inside surface of wall



MAXIMUM AND MINIMUM TEMPERATURES
OF THE INSIDE SURFACES OF SUMMER WALLS AND THE
TIMES OF OCCURRENCE OF THESE TEMPERATURES

K = THERMAL CONDUCTIVITY OF WALL MATERIAL, BTU/(HR)(FT)(F)
ϱ = DENSITY OF WALL MATERIAL, LB/FT^3
c = SPECIFIC HEAT OF WALL MATERIAL, BTU/(LB)(F)
α = ABSORPTIVITY OF EXTERIOR SURFACE FOR SOLAR RADIATION

ASSUMPTIONS:

- CONSTANT INDOOR AIR TEMPERATURE
- OUTDOOR AIR FILM COEFFICIENT OF HEAT TRANSFER OF 4 BTU/(HR)(FT^2)(F)
- TYPICAL HOURLY VARIATION IN TEMPERATURE OF OUTDOOR AIR
- TYPICAL HOURLY VARIATION IN INCIDENT SOLAR RADIATION
- RATE OF HEAT TRANSFER AT INSIDE WALL SURFACE OF 1.5 BTU/(HR)(FT^2) FOR EACH DEG OF TEMPERATURE DIFFERENCE BETWEEN SURFACE AND INDOOR AIR

INSTRUCTIONS FOR USE:

1. ENTER CHART A WITH WALL THICKNESS; GO HORIZONTALLY TO RIGHT TO THERMAL CONDUCTIVITY, K, (OR MATERIAL NAME)
2. GO VERTICALLY DOWN TO PRODUCT OF CONDUCTIVITY AND VOLUMETRIC SPECIFIC HEAT, Kϱc, (OR MATERIAL NAME) ON CHART B
3. GO HORIZONTALLY TO LEFT TO PROPER SCALE INCLUDING EFFECT OF ABSORPTIVITY AND ORIENTATION; READ TIMES OF DAY OF MAXIMUM AND MINIMUM TEMPERATURES
4. CONTINUE VERTICALLY DOWN ON 2 TO PRODUCT OF CONDUCTIVITY AND VOLUMETRIC SPECIFIC HEAT, Kϱc, (OR MATERIAL NAME) ON CHART C
5. GO HORIZONTALLY TO LEFT TO PROPER SCALE AND READ MAXIMUM AND MINIMUM TEMPERATURES OF INSIDE SURFACE

EXAMPLE

8 IN BRICK WALL FACING EAST; K = 0.417; Kϱc = 8.3; α = 0.7

MINIMUM TEMP OF INSIDE SURFACE IS 79.4 F AT 10:30 A. M.

MAXIMUM TEMP OF INSIDE SURFACE IS 86.3 F AT 2 P. M.

Fig. 4—Chart showing example with maximum temperature of inside surface of 86.3 F and a minimum of 79.4 F

on the curve of equivalent outdoor air temperature at the time θ_1. Add the time lag to the hour θ_1 and find the temperature of the inside surface of the wall at this new time from the steady-flow Equation 1, using λ_o in place of $\frac{U}{h_o}$; or at the time $(\theta_1 + \frac{\phi_o}{15})$, the temperature of the inside surface is

$$t_o = t_i + \lambda_o\ (t_{e1} - t_i) \ldots . [13]$$

An example will illustrate the procedure. Consider the 16 in. brick West wall, for which results have previously been given. For this wall, $a = 0.7$, $k = 0.417$, $\rho c = 19.9$, and $L = 1.333$. The fundamental lag angle will be found to be 180 deg (time lag of 12 hours), and the fundamental equivalent thermal resistance ratio (λ_0) is 0.0297. Values read from the equivalent outdoor air temperature curve, Fig. 1, and approximate values for the temperature of the inside surface of the wall at the stated times calculated from Equation 13 are shown in Table 2. For comparison, exact values of the temperatures of the inside surface of the wall, as found from the complete series solutions, are given in the last column of the table.

In a case which is a particularly severe test due to the great departure from steady flow conditions, the approximate method is seen to give a maximum temperature of the inside wall surface that is only 0.4 F less than the true maximum and at substantially the same time of day as the true occurrence; the minimum temperature is 0.7 F less than the true minimum at substantially the time of day of the true occurrence.

Table 2—Approximate solution for inside surface temperature (16 in. brick west wall)

Time of Day Θ_1	Equivalent Outdoor Air Temperature (Fig. 1) t_{e1}	Time of Day for Corresponding Inside Surface Temperature $\Theta_1 + \frac{\phi_0}{15}$	Approximate Temperature of Inside Wall Surface (Eq. 13) t_0	Exact Temperature of Inside Wall Surface; calculated from complete series solution. (Fig. 2)
12 noon	93.7	12 midnight	80.4	81.7
1 P.M.	108.3	1 A.M.	80.8	81.8
2	120.5	2	81.2	81.9
3	128.1	3	81.4	81.9
4	129.4	4	81.5	81.8
5	121.5	5	81.2	81.7
6	101.2	6	80.6	81.6
7	86.7	7	80.2	81.4
8	81.0	8	80.0	81.2
9	78.1	9	79.9	81.0
10	75.2	10	79.9	80.9
11	72.5	11	79.8	80.7
12	69.9	12 noon	79.7	80.6
1 A.M.	67.7	1 P.M.	79.6	80.4
2	66.0	2	79.6	80.4
3	65.0	3	79.6	80.3
4	65.2	4	79.6	80.3
5	66.7	5	79.6	80.3
6	69.2	6	79.7	80.4
7	73.0	7	79.8	80.6
8	77.5	8	79.9	80.8
9	82.2	9	80.1	81.1
10	86.9	10	80.2	81.3
11	90.8	11	80.3	81.6

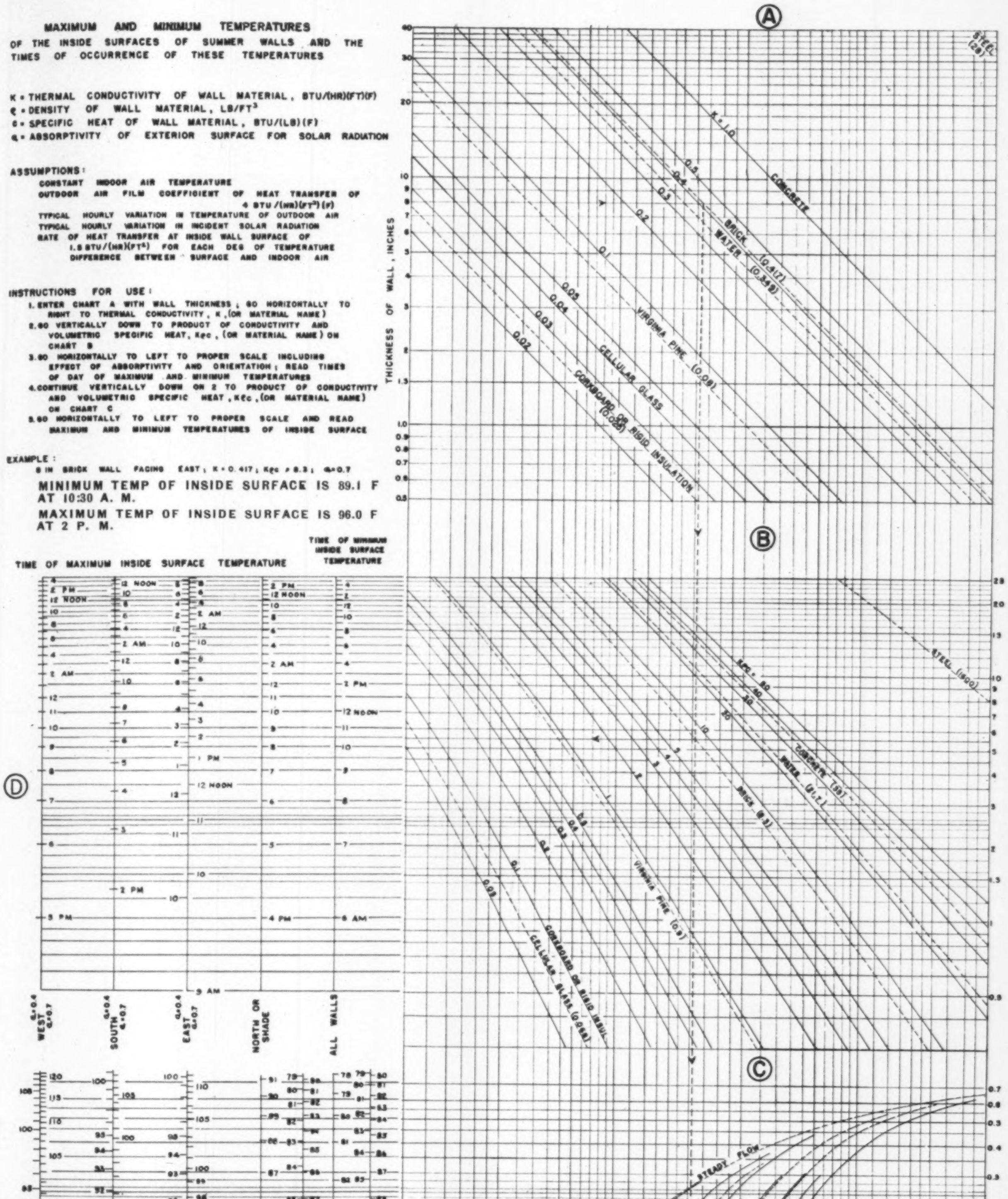
Table 3—Thermal properties of material represented in Fig. 4 and Fig. 5

Material	Thermal Conductivity k Btu/(hr)(ft)(F)	Volumetric Specific Heat ρc Btu/(ft³)(F)	Product $k\rho c$ Btu²/(hr)(ft⁴)(F²)
Cellular Glass	0.04	1.71	0.0684
Corkboard and Rigid Insulation	0.025	4.0	0.10
Virginia Pine	0.08	11.2	0.896
Brick (low-density)	0.417	19.9	8.3
Water	0.349	62.3	21.7
Concrete	1.0	35	35
Steel	28	57	1600

To eliminate the calculations and to give a picture of the effects of the thermal properties of the wall materials on cooling load and comfort, the charts in Figs. 4 and 5 have been prepared. In these two figures, charts A, B, and C are exactly the same; these three parts are a solution of Equation 6 and Equation 5 of this paper and may be used to find the fundamental time lags and fundamental equivalent thermal resistance ratios for a single-layer wall of any material in any thickness if the thickness, thermal conductivity, and volumetric specific heats of the wall are known. These results are *entirely independent* of the exact variation with respect to time of outdoor air temperature and incident solar radiation. The only assumptions made in the preparation of these three parts are that the outdoor air film coefficient of heat transfer (h_L) is 4.0 Btu/(hr)(ft²)(F) and that the rate of heat transfer at the inside surface of the wall is 1.5 Btu/(hr)(ft²) for each degree of difference between the temperature of the inside surface of the wall and the temperature of the indoor air. Dotted lines are shown on these charts for cellular glass, corkboard or rigid insulating board, Virginia pine, low-density brick, water, concrete, and steel. The thermal properties assumed for these materials are given in Table 3. In case the user of the chart does not agree with the values assumed for these materials, he may substitute his own values for k and for $k\rho c$ and follow the solid lines.

In Fig. 4 are also given the maximum and minimum temperatures of the inside surface of the wall (chart E) and the times of occurrence (chart D) of these temperatures for a constant temperature of the indoor air of 80 F and for walls with an absorptivity for solar radiation of 0.4 and 0.7 facing East, South, and West, and for a wall completely shielded from solar and sky radiation. The value of solar absorptivity of 0.4 corresponds to extremely light colors of the exterior surface of the wall and 0.7 to medium dark colors.

In Figs. 4 and 5, the extremes of surface temperature (chart E) and the times of occurrence of these extremes (chart D) are based upon the variation of equivalent outdoor air temperatures shown in Fig. 6. This figure gives different results than those shown in Fig. 1. The values of Fig. 1 were based upon Weather Bureau observations for Ithaca, N. Y., where a range in the outdoor dry-bulb temperature of 30 F is common on a summer day when the maximum temperature is equal to that commonly used in selecting cooling equipment. From a study of Summer Weather Data published by the Marley Co. it was seen that the daily range of dry-bulb temperature on a design day



MAXIMUM AND MINIMUM TEMPERATURES
OF THE INSIDE SURFACES OF SUMMER WALLS AND THE TIMES OF OCCURRENCE OF THESE TEMPERATURES

K = THERMAL CONDUCTIVITY OF WALL MATERIAL, BTU/(HR)(FT)(F)
ρ = DENSITY OF WALL MATERIAL, LB/FT³
c = SPECIFIC HEAT OF WALL MATERIAL, BTU/(LB)(F)
a = ABSORPTIVITY OF EXTERIOR SURFACE FOR SOLAR RADIATION

ASSUMPTIONS:
- CONSTANT INDOOR AIR TEMPERATURE
- OUTDOOR AIR FILM COEFFICIENT OF HEAT TRANSFER OF 4 BTU/(HR)(FT²)(F)
- TYPICAL HOURLY VARIATION IN TEMPERATURE OF OUTDOOR AIR
- TYPICAL HOURLY VARIATION IN INCIDENT SOLAR RADIATION
- RATE OF HEAT TRANSFER AT INSIDE WALL SURFACE OF 1.5 BTU/(HR)(FT²) FOR EACH DEG OF TEMPERATURE DIFFERENCE BETWEEN SURFACE AND INDOOR AIR

INSTRUCTIONS FOR USE:
1. ENTER CHART A WITH WALL THICKNESS; GO HORIZONTALLY TO RIGHT TO THERMAL CONDUCTIVITY, K, (OR MATERIAL NAME)
2. GO VERTICALLY DOWN TO PRODUCT OF CONDUCTIVITY AND VOLUMETRIC SPECIFIC HEAT, Kρc, (OR MATERIAL NAME) ON CHART B
3. GO HORIZONTALLY TO LEFT TO PROPER SCALE INCLUDING EFFECT OF ABSORPTIVITY AND ORIENTATION; READ TIMES OF DAY OF MAXIMUM AND MINIMUM TEMPERATURES
4. CONTINUE VERTICALLY DOWN ON 2 TO PRODUCT OF CONDUCTIVITY AND VOLUMETRIC SPECIFIC HEAT, Kρc, (OR MATERIAL NAME) ON CHART C
5. GO HORIZONTALLY TO LEFT TO PROPER SCALE AND READ MAXIMUM AND MINIMUM TEMPERATURES OF INSIDE SURFACE

EXAMPLE:
8 IN BRICK WALL FACING EAST; K = 0.417; Kρc = 8.3; a = 0.7

MINIMUM TEMP OF INSIDE SURFACE IS 89.1 F AT 10:30 A. M.

MAXIMUM TEMP OF INSIDE SURFACE IS 96.0 F AT 2 P. M.

Fig. 5—Chart showing example with maximum temperature of inside surface of 96.0 F and a minimum of 89.1 F

in many cities is under 20 F; for example, the daily range of dry-bulb temperature in Pittsburgh, where tests on wall panels were made by the ASHVE Research Laboratory, is usually less than 30 F. The dry-bulb temperature of the outdoor air assumed in Fig. 6 is the one given for New York in Summer Weather Data; this curve gives a maximum outdoor air temperature of 93.5 F at 3 P.M. and a minimum outdoor air temperature of 76 F at 5 A.M. The incident solar radiation used in Fig. 6 includes direct solar radiation and sky radiation and is that given in the ASHVE Guide 1942 as typical for August 1 and a North latitude of 40 deg. Values of equivalent outdoor air temperatures based upon these data for absorptivities of 0.4 and 0.7 are given in Table 4.

Another use of Fig. 4 is in the correlation of the effects of thickness and properties of the wall materials on cooling load. In his analysis of the cooling load, the air conditioning engineer is interested in the rate of heat transfer from the inside surface of the walls at other times than those of maximum and minimum surface temperatures, and this additional information is also needed in a complete study of comfort. Such information may be obtained by using the equivalent outdoor air temperature (Fig. 6), charts A, B, and C, and the approximate method of solution for surface temperature. From Equation 13, the approximate temperature of the inside surface of the wall at any time θ_1 is

$$t_{o1} = t_i + \lambda_o (t_{e1} - t_i).$$

The temperature of the inside surface of the wall at any other time θ_2 is

$$t_{o2} = t_i + \lambda_o (t_{e2} - t_i).$$

Therefore,

$$t_{o1} - t_{o2} = \lambda_o (t_{e1} - t_{e2}).$$

To find the temperature of the inside surface of the wall at any time, subtract from the maximum temperature of the inside surface the product of λ_o (chart C) and the difference between the *maximum* equivalent outdoor air temperature and the equivalent outdoor air temperature at that time, after making a correction for the time lag (chart B). The corresponding rate of heat transfer from the inside surface of the wall in Btu/(hr)(ft²) is

$$q = h_o (t_o - t_i) = 1.5 (t_o - t_i).$$

This procedure will next be shown by an illustrative example. It is

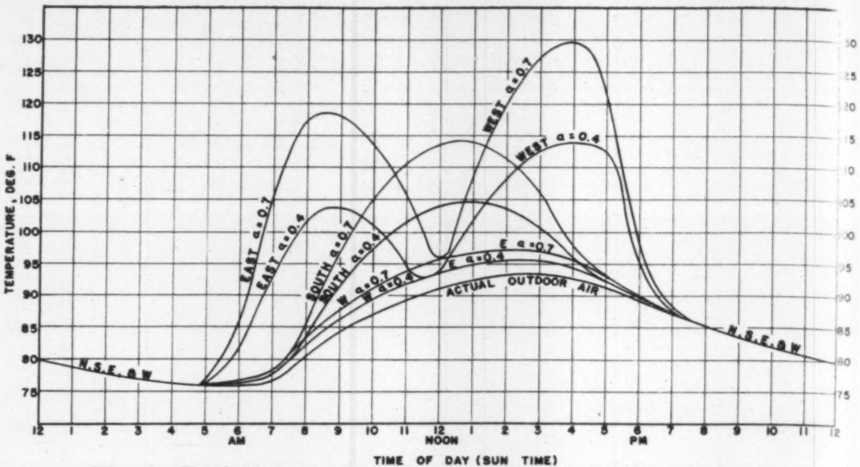


Fig. 6—Equivalent outdoor air temperatures for Figs. 4 and 5

Table 4—Equivalent outdoor air temperatures (see Fig. 6). Actual outdoor air temperature from Summer Weather Data (New York.) Incident solar and sky radiation from ASHVE Guide 1932. (40 deg N. lat., Aug. 1.) Assumed outdoor air film coefficient of heat transfer = 4 Btu/(hr)(ft²)(F)

Sun Time	Outdoor Dry-Bulb Temperature F	Equivalent Outdoor Temperature, F — Absorptivity = 0.4 — Wall Facing E	S	W	Absorptivity = 0.7 — Wall Facing E	S	W
12 noon	91.2	93.8	104.0	93.8	95.8	113.6	95.8
1 p.m.	92.4	94.9	104.8	101.8	96.9	114.1	108.8
2 p m.	93.2	95.5	103.5	108.4	97.3	111.2	119.8
3 p.m.	93.5	95.6	100.9	113.0	97.1	106.4	127.6
4 p.m.	92.9	94.6	95.8	114.0	95.9	97.8	129.8
5 p.m.	91.4	92.5	92.5	107.6	93.1	93.1	120.8
6 p.m.	89.0	89.4	89 4	94.6	89.8	89.8	98.8
7 p.m.	87.0	87.2	87.2	87.6	87.4	87.4	88.1
8 p.m.	85.3	85.3	85.3	85.3	85.3	85.3	85.3
9 p.m.	83.6	83.6	83.6	83.6	83 6	83.6	83.6
10 p.m.	82.1	82.1	82.1	82.1	82.1	82.1	82.1
11 p.m.	80.9	80.9	80.9	80.9	80.9	80.9	80.9
12 midnight	79.8	79.8	79 8	79.8	79.8	79.8	79.8
1 a.m.	78.9	78.9	78.9	78.9	78.9	78.9	78.9
2 a.m.	77 9	77.9	77.9	77.9	77.9	77.9	77.9
3 a.m.	77.1	77.1	77.1	77.1	77 1	77.1	77.1
4 a.m.	76.4	76.4	76.4	76.4	76.4	76.4	76.4
5 a.m.	76.0	76.6	76.2	76.2	76.1	76.4	76.4
6 a.m.	76.0	81.6	76 4	76.4	85.8	76.8	76.8
7 a.m.	76 6	92.8	77.7	77.7	106.0	78.3	78.3
8 a.m.	80.6	101.7	83.5	82.3	117.5	85.5	83.6
9 a.m.	84.2	103.7	91.6	86.3	118 3	97.1	87.6
10 a.m.	87.0	102.2	97.3	89.3	113.6	105.0	91.1
11 a.m.	89.3	94.7	101.7	91.8	105.7	111.0	93.8
12 noon	91.2	93.8	104 0	93.8	95.8	113.6	95.8

Table 5—Temperatures of inside surface and heat transfer rates for 8-in. sunlit brick wall facing south

Time of Day Hours after Noon Θ_1	Equivalent Outdoor Air Temperature (Fig. 4)	Time of Day of Corresponding Inside Surface Temperature Hours after Noon $\Theta_2 = \Theta_1 + (\text{Lag})$	Temperature of Inside Surface of Wall at Θ_2	Rate of Heat Transfer from Inside Surface at Θ_2 Btu/(hr)(ft²)
0.5	114.2	6	85.6	8.40
1.5	112.8	7	85.4	8.10
2.5	109.1	8	84.8	7.20
3.5	101.7	9	83.6	5.40
4 5	95.4	10	82.5	3.75
5.5	91.6	11	81.9	2.85
6.5	88.6	12	81.4	2.10
7.5	86.2	13	81.0	1.50
8 5	84.4	14	80.7	1.05
9.5	82.7	15	80.5	0.75
10.5	81.4	16	80.3	0.45
11.5	80.2	17	80.1	0.15
12.5	79.2	18	79.9	—0.15
13 5	78.4	19	79.8	—0.30
14.5	77.4	20	79.6	—0.60
15.5	76.6	21	79 5	—0.75
16.5	76.1	22	79.4	—0.90
17.5	76.5	23	79.5	—0.75
18.5	77.5	24	79.8	—0.30
19.5	81.0	25	80.2	0.30
20.5	91.5	26	81.9	2.85
21.5	101.2	27	83.5	5.25
22 5	108.1	28	84.7	7.05
23.5	112.5	29	85.3	7.95

Table 6—Constant indoor air temperature for zero heat transfer, daily (for the equivalent outdoor air temperatures of Fig. 6 and Table 4)

Orientation	Constant Indoor Air Temperature — Solar Absorptivity 0.4	0.7
Completely shielded from solar and sky radiation	84.3 F	84.3 F
South	87.7	90.3
East and West	88.4	91.6

Table 7—Comparison of wall materials that give a minimum temperature of the inside wall surface at 12 noon (Fig. 5)

Material	Cellular Glass	Corkboard or Rigid Insulation	Virginia Pine	Brick (low density)	Concrete
$\frac{k}{L}$ (Btu/hr ft² F)	0.037	0.045	0.142	0.504	1.23
k (Btu/hr ft F)	0.04	0.025	0.08	0.417	1.0
Thickness (inches)	13	6.7	6.8	9.9	9.8
λ_o	0.01043	0.0155	0.043	0.108	0.175
Min. Temp., F West Wall, a = 0.7	91.4	91.3	90.9	89.9	88.9
Max. Temp., F West Wall, a = 0.7	92.0	92.2	93.2	95.7	98.3
Time of Max. Temp. West Wall, a = 0.7	11 p.m.	11 p.m.	11 p.m.	11 p.m.	11 p.m.

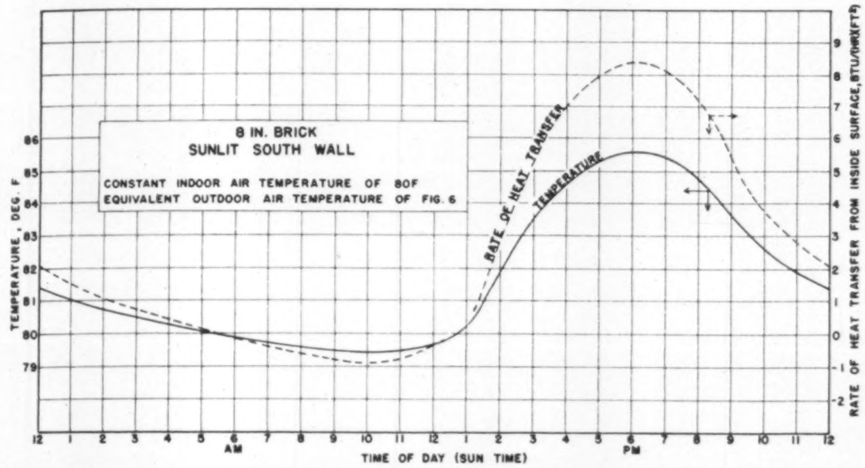


Fig. 7—Temperature of inside surface and rate of heat transfer to indoor air for 8-in. brick South wall

desired to find the hourly variation in the temperature of the inside surface and the rate of heat flow from that surface of an 8-in. brick (common low-density) wall facing South for a constant indoor air temperature of 80 F. The properties used for brick are those given in Table 3, the solar absorptivity will be taken as 0.7. From Fig. 4, with $\frac{k}{L} = 0.625$, the time lag is 5.5 hours and $\lambda_o = 0.163$. From Fig. 4, the maximum temperature of the inside surface of the wall is 85.6 F occurring about 6 hours after noon. From Fig. 6, the maximum equivalent outdoor air temperature is 114.2 F occurring about 0.5 hours after noon. At 7 hours after noon, then, the temperature of the inside surface of the wall will be 85.6 F minus the product of λ_o and the difference between the equivalent outdoor air temperatures at 0.5 hours and at 1.5 hours after noon, or

$$t_o = 85.6 - 0.163\ (114.2 - 112.8)$$
$$= 85.4 \text{ F.}$$

The remainder of the calculation is shown in Table 5 and the results are plotted in Fig. 7. Obviously, results may be found for other walls of any thickness, thermal properties, and orientation in a similar manner. It should be emphasized that the times used throughout this paper are sun times. Although the solution is approximate, a comparison with exact results, as previously shown in this paper, will show that the error is not greater than that usually introduced due to lack of *precise* knowledge concerning the important thermal properties of the wall materials.

The extremes of surface temperature (chart E) and the times of their occurrence (chart D) of Fig. 5 are for the case where no cooling equipment is operated within the room and are based upon a constant indoor air temperature equal to the mean equivalent outdoor air temperature for each orientation; in this case the net daily gain of heat through the wall is zero. The *only difference* between Figs. 4 and 5, then, is that Fig. 4 is drawn for a constant indoor air temperature of 80 F, while Fig. 5 is for the constant indoor air temperature given in Table 6.

The effect of thickness and thermal properties of the wall upon the extreme temperatures and upon time lag, shown in Fig. 5, may be used in the selection of walls for uncooled enclosures with the purpose of providing the maximum comfort during the time of occupancy. For example, assume that a single layer wall is to be selected which will give a minimum temperature of the inside surface near the middle of the day, say, at 12 noon. Regardless of orientation, chart D of Fig. 5 shows that the time lag must be 7 hours. Following this time lag into chart B and up into chart A, the thickness of the wall of any specified material may be found; from the fundamental λ of chart C, the actual minimum temperature of each inside surface may be read on the scale of chart E or calculated. Results of the comparison are shown in Table 7.

Summary of Results

1. Charts are presented that give the maximum and minimum temperatures, and the times of occurrence of these temperatures, for single layer walls of any material, thickness, and principal orientation, when the temperature of the indoor air is constant.

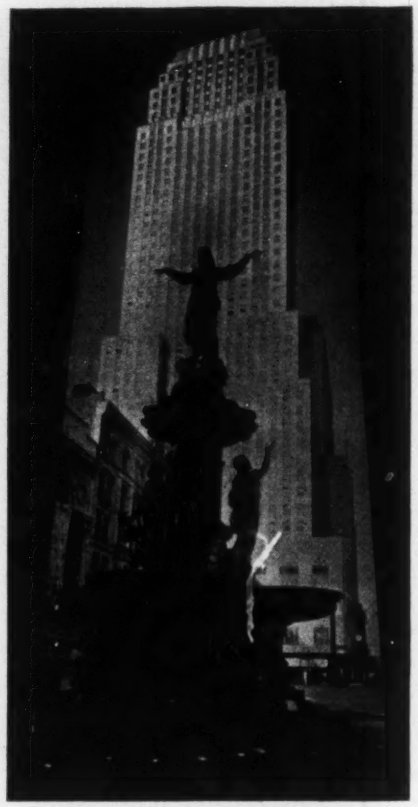
2. A simple, approximate method of finding the effects of thickness and thermal properties of wall materials upon the hourly variation in the rate of heat flow at the inside surface is given for single-layer walls with any hourly variation in the outdoor air temperature and in the incident solar radiation and for any assumed constant temperature of the indoor air. This method is as accurate as the usual knowledge of the thermal properties of the wall materials and may be used to correlate experimental results previously obtained. Actual experimental tests on this problem are now being conducted at the John B. Pierce Laboratory of Hygiene.

3. The effects of thermal properties and thickness of wall materials upon conditions influencing comfort in an uncooled enclosure are discussed and examples given. The choice of the thermal properties and thickness of the wall materials for comfort is shown to be intimately associated with the orientation and time of occupancy of a room. It is shown that a building with all walls of the same material in a uniform thickness does not meet the ideal thermal requirements.

Acknowledgment

The authors wish to acknowledge the support and interest of the John B. Pierce Foundation which made possible the study presented in this paper. In particular, they acknowledge the helpful ideas and interest of Robert L. Davison, Director of Research, John B. Pierce Foundation. Valuable assistance in the calculations and preparation of the charts was given by R. E. Clark, Assistant Professor of Heat-Power Engineering, and N. R. Gay, Instructor of Heat-Power Engineering, both of Cornell University.

49th ANNUAL MEETING



Davidson Fountain and Carew Tower

FEATURES
Fuel Conservation

●

Research to Aid War Production

●

Manpower Problems

●

Physiological Studies Affecting Efficiency and Health

THE MEETINGS Committee of the Society has prepared a streamlined program for the 49th Annual Meeting at Cincinnati, O., January 25 to 27, 1943, with four business and technical sessions scheduled for January 25 and 26.

Registration will commence on January 24, at the Hotel Gibson, and preliminary Committee Meetings will be held on that day.

The first technical session will open at the Hotel Gibson, Monday, January 25, at 9:30, and in addition to the Reports of Officers and Committees, discussions of ship ventilation and modern methods of food dehydration are planned.

One of the important matters to be brought up at this session is the Report of the Committee on Constitution and By-Laws relating to the method of choosing Society Officers and Council Members. The Committee was authorized by vote of the Society to study all available reports and discussions on this subject and prepare suitable by-laws for consideration. A progress report on the Committee's work was sent to the members in a letter dated October 31, and the form of the By-Law to be drafted will be governed by the comments of the members.

At noon on Monday, January 25, a Get-together Luncheon with the Cincinnati Engineers Club will be held at the Hotel Gibson and the principal speaker will be Dr. B. M. Woods, University of California, on the subject of Manpower Problems in Engineering.

The afternoon session will feature papers on Army Fuel Requirements, Performance of Space Heaters, and the Results of Operating Residence Heating Systems with Reduced Night Temperatures.

A special feature of this session will be a panel discussion on a question to be announced later.

Albert Buenger, General Chairman of the Committee on Arrangements, invites everyone to attend the informal dinner and Ice Show on Monday evening at the Netherland Plaza Hotel. This, and the Annual Banquet on Tuesday evening, will be the principal entertainment events.

On Tuesday, the morning session will be devoted to presentation of research results, many of which are of value for war production purposes, and the afternoon session will cover a discussion of physiological factors relating to comfort and health. A panel discussion is planned on the subject of How to Keep Fit in Cold Homes and will be conducted by Prof. C.-E. A. Winslow. The participants in this discussion will be physicians of national reputation, a housing manager and insulation expert, and a housewife.

A special program for visiting ladies is being planned by Mrs. G. B. Houliston, Chairman of the Ladies Committee.

President Hard and the members of the Cincinnati Chapter send a

CHOOSE YOUR ROUTE TO CINCINNATI

Cincinnati is served by the following railroad systems and connecting lines (consult local ticket agent for rates and schedules):

Baltimore and Ohio
Chesapeake and Ohio
Louisville and Nashville
New York Central
Norfolk and Western
Pennsylvania
Southern Railway

Three airlines have frequent service to principal cities.

AMERICAN AIRLINES — DELTA AIRLINES — TWA

TENTATIVE PROGRAM

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

January 25-27, 1943
Hotel Gibson
Cincinnati, Ohio

Aerial view, University of Cincinnati

January 24, 1943

10:00 a.m. Registration.
10:00 a.m. Meeting, Committee on Research.
2:00 p.m. Council Meeting.
7:30 p.m. Chapter Delegates Conference.

January 25, 1943

9:00 a.m. Registration.
9:30 a.m. TECHNICAL SESSION.
  Reports of Officers and Committees.
  Warship Ventilation System Design, by Urdahl and Whittlesey.
  Modern Methods of Food Dehydration.
  Report of Tellers.
12:15 p.m. Get-together Luncheon—Speaker, Dr. B. M. Woods, University of California.
  SUBJECT—The Manpower Problem in Engineering.
2:00 p.m. TECHNICAL SESSION.
  Army Fuel Requirements, by McCabe, Konzo and Biller.
  Performance of Coal-Fired Space Heaters, by R. C. Cross.
  Residence Heating Operation with Reduced Night Temperatures, by Kratz, Harris and Fahnestock.
6:30 p.m. Dinner and Ice Show—Netherland Plaza Hotel.

January 26, 1943

9:00 a.m. Registration.
9:30 a.m. TECHNICAL SESSION.
  Comparative Resistance to Vapor Transmission of Various Building Materials, by L. V. Teesdale.
  Summer Comfort Factors as Influenced by the Thermal Properties of Building Materials, by C. O. Mackey and L. T. Wright, Jr.
  Friction Heads due to Water Flow in Copper, Brass and Other Smooth Pipes, by F. E. Giesecke.
  Performance of Side Outlets on Horizontal Ducts, by D. W. Nelson and G. E. Smedberg.
2:00 p.m. TECHNICAL SESSION.
  Panel Discussion—How to Keep Fit in Cold Homes.
  Conducted by Prof. C.-E. A. Winslow.
7:00 p.m.—ANNUAL BANQUET—Installation of Officers; Presentation of Past President's Emblem.

January 27, 1943

9:00 a.m. Organization Meeting of Council.

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cordial invitation to all Society members to come to Cincinnati for the 49th Annual Meeting and it is their hope that the program will attract a large attendance.

Cincinnati is centrally located and is readily accessible by rail and air service. It has adequate hotel facilities but members are requested to make early train and hotel reservations.

The Committee on Arrangements, under the direction of Albert Buenger, is hard at work planning a meeting that no one will want to miss as it will be a real contribution to the war program.

MEETING ON FUEL RATIONING IN CHICAGO ON DECEMBER 14

The December 14 meeting of the Illinois Chapter of the ASHVE is to be devoted to fuel oil rationing problems. Matt S. Kilgallon, who heads the fuel oil rationing activities of the OPA in the Chicago area, is the principal speaker, and chapter members and others who have been working in an advisory capacity with local boards will also speak.

Chapter officers expect a large attendance, as announcements are being mailed to all engineers in the Chicago area who are assisting the rationing boards, as well as to many board members. Everyone interested in the subject is urged to attend. The meeting will be held in the Merchants and Manufacturers Club of the Merchandise Mart, North Wells St. and the River, at 7:30 p.m., with dinner preceding at 6:00 p.m. If you plan to attend and do not receive a reservation card, write or phone A. O. May, Room 925, 53 W. Jackson Blvd., Chicago (Harrison 1501) for a reservation.

Under the leadership of the chapter president, E. M. Mittendorff, and the chairman of the chapter's engineering advisory committee for fuel conservation, John Howatt, the Illinois chapter of the society is cooperating with the Office of Price Administration in Chicago by naming heating engineers to work with local rationing boards on fuel and heat conservation. Instructions were given these volunteer workers at a lively and well attended meeting held November 13. Speakers included Michael Mulcahy, David Clint, and Mr. Kilgallon, of the OPA, and Mr. Howatt.

SUMMARY OF LOCAL CHAPTER MEETINGS

CHAPTER	MEETING DATE	SUBJECT	SPEAKERS	OTHER FEATURES	ATTENDANCE	ATTENDANCE RATIO*
Montreal	October 19	Fuel Combustion (mainly coal).	Robert Rodgers	Report of Committee studying method of determining heat loss for heating design.	31	0.46
Wisconsin	October 19	Flow of Air and Gases.	S. H. Downs		40	0.62
	September 21	Development of the Marine Type Stationary and Portable Boilers.	Fred Hainer	Messrs. F. W. Goldsmith, H. F. Alfery, Ernest Szekely, and D. W. Nelson were appointed members of Associated Defense Committee.	40	0.62
Washington, D. C.	October 14	Fuel Oil Rationing.	James A. Coble, Planning Div. of Fuel Oil Rationing Board, OPA.	Dinner preceded meeting.	21	0.21
Cincinnati	October 13	An Engineer's Adventures in Latin America.	Bernie Silberstein	Chapter Membership gave 100 per cent support of the National Officers Annual Meeting Activities to make it a big success.	20	0.45
	September 28	Annual Fall Round-up Blind Bogie Golf Tournament.		Golf Tournament.	27	0.47
		Fuel Conservation. National Defense.	Capt. C. E. Hust Lt. G. L. Leupold	Discussion of Annual Meeting in January, 1943.		
Iowa	October 13	Fuel Savings.	Chapter Members	Motion to appoint committee to discuss and outline material that should be used in Bulletin issued by Iowa State College, Ames, Ia., to guide people in steps to be taken to save fuel.	18	0.55
Illinois	October 12	Adventures in War Preparation and Production.	S. R. Lewis	T. M. Cunningham spoke on substitute materials in duct work. C. E. Price unanimously elected to Vice-Presidency to fill vacancy created by M. W. Bishop's resignation.	60	0.53
Pittsburgh	October 12	Use of Cold Accumulators in the Air Conditioning Field.	C. J. Otterholm, Minneapolis, Minn.	Slides.	20	0.35
Western Michigan	October 12	District Heating.	John F. Collins, Jr., Pittsburgh, Pa.	Discussion on Fuel Savings, and Fuel Oil Rationing.	34	0.60
Western New York	October 12	Panel Heating.	Peter B. Gordon, New York, N. Y.	Dinner Meeting.	26	0.47
Northern Ohio	October 12	Air Conditioning as the Allergist Sees It.	Dr. M. B. Cohen	Treasurer's Report accepted.	25	0.42
		The War Training Program.	Prof. C. A. McKeeman	Announcement of plans to contact Northern Ohio industries for research fund contributions. Education program for saving fuel announced. Accepted invitation to hold joint meeting with *ASRE* in November.		

CHAPTER	MEETING DATE	SUBJECT	SPEAKERS	OTHER FEATURES	ATTENDANCE	ATTENDANCE RATIO*
Northern Ohio	October 9	Golf and dinner party.		Presentation of awards.	33	0.55
Oregon	October 8	War on Fuel Waste Week.	J. Donald Kroeker, Chairman of Committee on Fuel Conservation.	Nominating Committee elected. Means of providing waivers of Portland's code on heating to comply with WPB orders were outlined.	26	0.62
Southern California	October 7	We Have a War to Win.	Chester Fields	Leo Hungerford appointed to represent Southern California Chapter on Refrigeration Manpower Survey Committee.	27	0.21
	September 2	Production Methods in the Manufacture of Magnesium and Aluminum from the Ores.	Dr. Robert Evans Vivian, Dean, College of Engineering, University of Southern California.	Social Hour and illustrations by Dr. Vivian.	45	0.35
Philadelphia	October 8	Fuel Rationing.	C. W. Whitney, Frank Trembly, Frank Earnest, Henry Norris, Mr. Nolkan and A. J. Johnson	Signing up of Chapter members to serve as consultants to local Rationing Boards.	180	1.50
St. Louis	October 6	Smoke Elimination Program Under War Conditions.	Prof. R. R. Tucker Chairman of Dept. of M. E., Washington University, St. Louis, Mo.		27	0.41
	September 8	Application of Electric Motors to Heating Ventilating and Air Conditioning Equipment.	G. N. Harris	I. W. McLarney appointed to fill vacancy in Board of Governors left vacant by resignation of Bruce Evans.	20	0.28
Ontario	November 2	Air Cleaning.		Fuel Oil and Its Limitations During Wartime, by A. S. Morgan.	63	0.63
			W. B. Firner, R. Taylor and O. G. Moffa	Discussion on Air Filter Applications.		
	October 5	Plastics. Wartime Prices and Trade Board. Fuel Conservation.	A. E. Byrne H. D. Henion I. H. Angus		65	0.65
Atlanta	September 1	Locker Plants.	C. T. Baker	Discussion on Mr. Baker's talk. Suggestions for luncheon meetings with Georgia Engineering Society.	45	0.93
Kansas City	October 19	California Giants.	Frank R. Adams, Industrial Sales Mgr. California Redwood Distributors, Ltd.	Motion by N. P. Downes to waive local dues of men in service. Motion carried.	40	0.90
	July 10	Report on St. Paul Meeting in June.	M. M. Rivard	J. M. Arthur, Jr., submitted list of officers for 1943, and on motion of E. K. Campbell, seconded by F. F. Dodds, the officers were unanimously elected.	12	0.30
Golden Gate	September 9	How to Select Motors and Control Equipment.	L. Dean Fowler	Fall Meeting. Members Chapter's guests at luncheon.	27	0.39

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*The attendance ratios shown represent the meeting attendance divided by the Chapter membership. These will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by other local chapters, and may be helpful in deciding on subjects for other chapter meetings.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the Journal of the Society or sent to the members in other approved manner as ordered by the Council. When replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 25 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by December 15, 1942, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

CANDIDATES	REFERENCES *Proposers*	 *Seconders*
BAKKE, GEORGE V., Student, University of Minnesota, Minneapolis, Minn.	R. C. Jordan F. B. Rowley	C. E. Lund H. M. Betts
BULLER, CHARLES R., Chief Engr., The Heil Co., Milwaukee, Wis. (*Reinstatement*)	A. S. Krenz Ernest Szekely	O. A. Trostel H. W. Schreiber
CLARKSON, ROBERT C., Jr., Consulting Engr., Drexel Hill, Pa. (*Reinstatement*)	J. H. Hucker S. E. Plewes	H. G. Black A. E. D'Ambly
COLEMAN, LOUIS, Mgr. Technical Div., Majestic Refrigerator Corp., New York, N. Y.	A. W. Akers G. A. Belsky	H. E. Williams *H. E. Fidel
CORBIT, CHARLES A., Pres., Corbit's, Inc., Reading, Penn.	A. J. Nesbitt G. E. Plewes	H. B. Hedges D. C. Wiley
CUPITT, ROBERT, Asst. Tech. Engr., Brockhouse Heater Co., West Bromwich Staffs, England.	W. N. Mann S. F. Greenland	
DAVIES, RICHARD H., Asst. Engr., Ministry of Supply, British Gov., England	*P. J. Metcalf *G. W. Germain	*J. D. Moran *Martin Price
ERNST, JOHN P., Student, University of Minnesota, Minneapolis, Minn.	R. C. Jordan F. B. Rowley	C. E. Lund H. M. Betts
GEIRINGER, PAUL L., Mech. Engr., Jackson & Moreland, Boston, Mass.	*M. E. Johnson *L. C. Roy	*H. Chisholm *T. A. Bullock
HIMELBLAU, HARRY, Secy-Treas., Himelblau, Byfield & Co., Chicago, Ill.	A. O. May M. F. Mattingly	G. V. Zintel A. H. Blaker
HOLLAND, WILLIAM T., Engr., Thos. E. Hoye Heating Co., Milwaukee, Wis. (*Advancement*).	H. W. Schreiber J. H. Volk	J. S. Jung C. H. Randolph
HOW, CECIL P., Dir. & Gen. Mgr., The Brightside Foundry & Engineering Co., Ltd., Birmingham, England	T. N. Adlam W. Harding	*D. Richardson J. J. Fraser
JENNINGS, HAL K., Dist. Mgr., Avery Engrg. Co., Cincinnati, Ohio. (*Reinstatement*)	E. W. McNamee G. V. Sutfin	A. W. Edwards W. H. Junker
KAPLUN, EUGENE, Designing Engr., Dwight D. Kimball, New York, N. Y.	D. D. Kimball Martin Jarcho	Thomas Baker H. J. Rose
MACDERMOT, SIDNEY G., Mgr. Construction Dept., Johns-Manville Co., Ltd., Montreal, P. Q., Canada.	R. R. Noyes F. A. Hamlet	C. W. Johnson A. M. Peart
MAYER, WILLIAM J., Mgr., Engrg. Service Dept., A. M. Byers Co., Pittsburgh, Pa.	J. B. Fullman John James	C. M. Humphreys F. C. McIntosh
NORBY, KARL H., Mgr. Heating Dept., Tacoma Plumbing Supply Co., Tacoma, Wash. (*Advancement*).	J. H. Faulkner H. T. Griffith	E. H. Langdon R. D. Morse
PETERS, HUGO C., Htg. Engr., U. S. Engineers, Mitchell Field, Hempstead, N. Y.	*R. G. Richards *J. C. Guibert	*E. R. Closs *J. M. Welsch
PLAMONDON, SARTO R., Engr., Ministry of Health and Social Welfare, Quebec, P. Q. Canada	J. M. Paquet Leo Roy	A. F. Lamontagne J. G. Chenevert
POOLE, GORDON D., Dist. Engr., Johns-Manville Co., Ltd., Montreal, Que., Canada.	R. R. Noyes F. A. Hamlet	C. W. Johnson Leo Garneau
PURDUE, FRANK, Chief Engr., Odhams Ltd., Watford, Hertfordshire, England	Ben Offen Edgar Herring	S. M. Trumbo *H. Midgely
SCOTT, FREDERICK W., Student, University of Minnesota, Minneapolis, Minn.	R. C. Jordan F. B. Rowley	C. E. Lund H. M. Betts
TATE, HOWARD L., Chief Engr., Titche-Goettinger Co., Dallas, Texas	W. M. Moler J. A. Bishop	E. T. Gessell M. L. Brown
THOMAS, RICHARD L., Sales Engr., Fairbanks-Morse, Kansas City, Mo.	E. K. Campbell H. A. Froelich	Carl Clegg D. M. Allen
VAN SISK, R. D., Vice-Pres., Piedmont Engineering Corp., Charlotte, N. C.	L. L. Vaughan R. B. Rice	C. E. Petty M. F. Wooten, Jr.

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*Non-member.

Candidates Elected

In the past issues of the Journal of the Society the names of the following men were listed as Candidates for Membership. The membership grade of each Candidate has been assigned by the Committee on Admission and Advancement and balloted upon by the Council. We are now instructed by the Council to post herewith, as required by Art. B-III, Sec. 8, of the By-Laws, the following list of candidates elected:

MEMBERS

Bemis, Paul D., Owner, Paul D. Bemis, Consulting Engr., Hartford, Conn.

Benson, Foster W., Application Engr., Niagara Blower Co., Chicago, Ill.

Gunzel, Rudolph M., Sales Repr., Kewanee Boiler Corp., Los Angeles, Calif. (*Reinstatement*).

McMullen, Ernest W., Partner, Ganteaume & McMullen, Boston, Mass.

ASSOCIATES

Bemis, Wilfred A., Sales Engr., N. O. Nelson Co., St. Louis, Missouri

Brown, William L., Jr., Co-owner, Brown Bros., Plmbg. & Htg. Co., Durham, N. C.

Calnan, Daniel J., Field Engr. & Repr., Electric Furnace Man, Inc., New York N. Y.

Devereux, James K., Sales Mgr., Monroe Armature Works, Monroe, La.

Sawyer, Howard C., Sales Exec. & Partner, Sawyer-Hare Furnace Co., Detroit, Mich.

Officers, Council and Committees

American Society of Heating and Ventilating Engineers

51 Madison Ave., New York, N. Y.

OFFICERS

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First Vice-President....................M. F. Blankin
Second Vice-President....................S. H. Downs
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Three Years: L. G. Miller, A. J. Offner, A. E. Stacey, Jr., B. M. Woods.

Two Years: A. P. Kratz, W. A. Russell, L. P. Saunders, C. Tasker.

One Year: J. F. Collins, Jr., W. L. Fleisher, E. N. McDonnell, T. H. Urdahl, C.-E. A. Winslow, F. C. McIntosh, *Ex-Officio*.

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Executive—W. L. Fleisher, *Chairman*, A. J. Offner, A. E. Stacey, Jr.

Finance—E. N. McDonnell, *Chairman*, J. F. Collins, Jr., C.-E. A. Winslow.

Membership—W. A. Russell, *Chairman*, M. F. Blankin, B. M. Woods.

Standards—S. H. Downs, *Chairman*, L. G. Miller, C. Tasker.

Meetings—A. P. Kratz, *Chairman*, L. P. Saunders, T. H. Urdahl.

ADVISORY COUNCIL

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ASHVE-*ASTM-ASRE-NRC Committee on Thermal Conductivity:* F. C. Houghten, *Chairman;* C. B. Bradley, H. C. Dickinson, R. H. Heilman, E. R. Queer, F. B. Rowley, T. S. Taylor and G. B. Wilkes.

ASHVE-*IES Joint Committee on Lighting and Air Conditioning*—H. M. Sharp, *Chairman;* W. R. Beach, B. C. Candee, W. G. Darley, C. L. Kribs, Jr., P. M. Rutherford, Jr.

Chapter Relations—J. F. Collins, Jr., *Chairman;* Lincoln Bouillon, M. M. Rivard.

Constitution and By-Laws—Albert Buenger, *Chairman;* L. T. Avery, R. H. Carpenter.

Committee on Code for Testing Surface Coils for Heating and Cooling—C. A. McKeeman, *Chairman;* Tom Brown, E. L. Hogan, H. F. Hutzel, L. E. Moody, A. F. Nass, S. F. Nicoll, M. Noble, L. P. Saunders, and D. C. Wiley.

Committee on Safety Regulations for Heating, Ventilating and Air Conditioning Systems—N. A. Hollister, *Chairman;* F. H. Buzzard, B. F. McLouth, G. P. Nachman, and C. H. Randolph.

Committee on ASHVE Code for Testing Air Cleaning Devices—John Howatt, *Chairman;* O. W. Armspach, J. L. Blackshaw, R. S. Dill, S. P. Eagleton, S. R. Lewis, Arthur Nutting, G. W. Penney, F. B. Rowley, J. H. Waggoner, and Dr. Leonard Greenburg, *Ex-Officio*

Guide Publication—A. J. Offner, *Chairman;* P. D. Close, S. Konzo, C. S. Leopold, G. L. Tuve.

F. Paul Anderson Award—M. F. Blankin, *Chairman;* W. H. Carrier, J. D. Kroeker, J. F. McIntire, F. B. Rowley.

Joint Committee on Standards for Residence Heating—L. E. Seeley, *Chairman;* R. S. Dill, S. H. Downs, H. L. Dryden, J. G. Eadie, H. C. Meyer, Jr., R. K. Thulman, T. H. Urdahl, and H. Vermillyea.

Joint Committee to Study Uniform Methods of Heat Loss Calculation—P. D. Close, *Chairman;* A. P. Kratz, J. P. Magos, G. P. Nachman, A. F. Nass.

Joint Committee on Weather Statistics—J. F. Collins, Jr., *NDHA*, *Chairman;* F. H. Dewey, *OBI;* C. M. Humphreys, ASHVE; S. Konzo, *NWAHACA;* Raymond Little, *AGA;* Dr. E. Dillen Smith, *U. S. Weather Bureau.*

Publication—James Holt, *Chairman* (*one year*); C. H. B. Hotchkiss (*two years*); J. H. Walker (*three years*).

War Service Committee—B. M. Woods, *Chairman;* W. A. Danielson, W. L. Fleisher, E. Holt Gurney, Thornton Lewis, A. C. Willard.

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Golden Gate	C. E. Bentley	
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Massachusetts	J. W. Brinton	Earl G. Carrier
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Minnesota	R. E. Backstrom	N. D. Adams
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Nebraska	Henry Kleinkauf	W. R. White
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Washington, D. C.	F. A. Leser	T. H. Urdahl
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Two Years: C. M. Ashley, M. K. Fahnestock, H. King McCain, F. C. McIntosh, T. H. Urdahl.

One Year: Philip Drinker, Axel Marin, A. E. Stacey, Jr., J. H. Van Alsburg, J. H. Walker.

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Finance Committee: C. F. Boester, *Chairman.*

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2. *Physiological Reactions:* C.-E. A. Winslow*, *Chairman;* Dr. Thomas Bedford, Thomas Chester, Dr. E F. DuBois, Dr. M. B. Ferderber, E. P. Heckel, John Howatt, Dr. R. W. Keeton, C. S. Leopold, André Missenard, Dr. R. R. Sayers, Charles Sheard, C. Tasker.

3. *Removal Atmospheric Impurities:* Dr. Leonard Greenburg, *Chairman;* J. J. Burke, J. M. DallaValle, R. S. Dill, Theodore Hatch, L. R. Koller, C. A. McKeeman*, F. H. Munkelt, H. C. Murphy, G. W. Penney Dr. E. B. Phelps, F. B. Rowley, W. O. Vedder, J. H. Waggoner, R. P. Warren, W. F. Wells.

4. *Radiation and Comfort:* J. C. Fitts, *Chairman;* A. H. Barker, L. M. K. Boelter, E. L. Broderick, R. E. Daly, J. B. Fullman, E. R. Gurney, L. N. Hunter, A. P. Kratz, C. S. Leopold, L. L. Munier, D. W. Nelson, W. J. Olvany, G. W. Penney, W. R. Rhoton, C. J. Stermer, C.-E. A. Winslow*.

5. *Instruments:* D. W Nelson, *Chairman;* L. M. K. Boelter, R. S. Dill, A. P. Gagge, J. A. Goff*, A. E. Hershey, F. W. Reichelderfer, G. L. Tuve, C. P. Yaglou.

6. *Weather Design Conditions:* T. H. Urdahl*, *Chairman*; J. C. Albright, H. S. Birkett, P. D. Close, John Everetts, Jr., C. M. Humphreys, O. A. Kinzer, H. H. Koster, J. W. O'Neill, F. W. Reichelderfer.

7. *Radiation with Gravity Air Circulation:* M. K. Fahnestock*, *Chairman;* R. E. Daly, R S. Dill, A. G. Dixon, H. F. Hutzel, J. P. Magos, J. W. McElgin, J. F. McIntire, T. A. Novotney, W. A. Rowe.

8. *Heat Transfer of Finned Tubes with Forced Air Circulation:* W. E. Heibel*, *Chairman*; C. M. Ashley*, William Goodman, H. F. Hutzel, Ferdinand Jehle, S. F. Nicoll, R. H. Norris, L. P. Saunders, R. J. Tenkonohy, G. L. Tuve, D. C. Wiley.

9. *Cooling Load in Summer Air Conditioning:* C. M. Ashley*, *Chairman;* J. H. Carter, John Everetts, Jr., F. C. Houghten, E. H. Hyde, C. S. Leopold, C. O. Mackey, R. M. Stikeleather, J. H. Walker*, W. E. Zieber.

10. *Air Distribution and Air Friction:* J. H. Van Alsburg*, *Chairman;* S. H. Downs, A. E. Hershey, W. W. Kennedy, A. P. Kratz, R. D. Madison, L. G. Miller, D. W. Nelson, C. H. Randolph, M. C. Stuart, Ernest Szekely, R. J. Tenkonohy, G. L. Tuve.

11. *Heat Requirements of Buildings:* P. D. Close, *Chairman;* E. K. Campbell, J. F. Collins, Jr., E. F. Dawson, W. H. Driscoll, H. M. Hart, E. C. Lloyd, H. H. Mather, H. King McCain*, M. W. MacRae, C. H. Pesterfield, F. B. Rowley, R. K. Thulman.

12. *Air Conditioning Requirements of Glass:* R. A. Miller, *Chairman;* C. M. Ashley*, L. T. Avery, F. L. Bishop, D. A. Bridges, W. A. Danielson, H C. Dickinson, J. D. Edwards, J. E. Frazier, E. H. Hobbie, C. L. Kribs, Jr., Axel Marin*, F. W. Parkinson, W. C. Randall, L. T. Sherwood, J. T. Staples, G. B. Watkins, F. C. Weinert.

13. *Sound Control:* J. S. Parkinson, *Chairman;* C. M. Ashley*, W. W. Kennedy, A. L. Kimball, V. O. Knudsen, R. D. Madison, C. H. Randolph, A E. Stacey, Jr.*, A. G. Sutcliffe, Thomas A. Walters, R. M. Watt, Jr.

14. *Cooling Towers, Evaporative Condensers and Spray Ponds:* B. M. Woods, *Chairman;* C F Boester*, W. W. Cockins, S. C. Coey, E. H. Kendall, S R. Lewis, H. B. Nottage, J. F. Park, E. T. Selig, Jr., E. W. Simons, E. H. Taze.

15. *Psychrometry:* J. A. Goff*, *Chairman;* F. R. Bichowsky, W. H. Carrier, H. C. Dickinson, R. S. Dill, A. W. Gauger, William Goodman, A. M. Greene, Jr., L. P. Harrison, F. G. Keyes A. P. Kratz, D. M. Little, Axel Marin*, D. W. Nelson, W. M. Sawdon.

16. *Flow of Fluids Through Pipes and Fittings:* S. R. Lewis, *Chairman;* L. A. Cherry, G. C. Davis, T. M. Dugan, Earle W. Gray, R. T. Kern, H. A. Lockhart, Axel Marin*, R. F. Taylor, E. L. Weber.

17. *Fuels:* R. A. Sherman, *Chairman;* R. M. Conner, R. S. Dill, R B. Engdahl, A. C. Fieldner, L. N. Hunter, S. Konzo, W. M. Myler, Jr., H. J. Rose, C. E. Shaffer, T. H. Smoot, R. K. Thulman, T. H. Urdahl*, E. C. Webb.

18. *Corrosion:* L. F. Collins, *Chairman;* H. E. Adams, N. D. Adams, J. F. Barkley, W. H. Driscoll, T. J. Finnegan, W. Z. Friend, E. W. Guernsey, W. E. Heibel*, A. R. Mumford, R. R. Seeber, E. T. Selig, Jr., F. N. Speller, C. M. Sterne.

19. *Air Conditioning in Industry:* W. L. Fleisher, *Chairman;* L. T. Avery, Dr. A. R. Behnke, Dr. Leonard Greenburg, W. E. Heibel*, L. L. Lewis, Dr. W. J. McConnell, Dr. C. P. McCord, P. A. McKittrick, Dr. R. R. Sayers, C. Tasker, R. M. Watt, Jr., H. E. Ziel.

20. *Summer Air Conditioning for Residences:* M. K. Fahnestock*, *Chairman;* Emerson Brandt, E. D. Milener, F. G. Sedgwick.

21. *Sorbents:* F. R. Bichowsky, *Chairman;* John Everetts, Jr., Ralph Fehr, John A. Goff*, W. R. Hainsworth, C. H. B. Hotchkiss, J. C. Patterson, G. L. Simpson.

22. *Insulation:* E. C. Lloyd, *Chairman;* H. King McCain*, J. D. Edwards, Paul McDermott, W. T. Miller, E. R. Queer, F. B. Rowley, G. L. Tuve, J. H. Waggoner.

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Heating, Piping & Air Conditioning

January-December, 1942—Vol. 14, Nos. 1-12

Published monthly by the Keeney Publishing Company, 6 N. Michigan Ave., Chicago, Ill.

As will be noted, these abstracts are classified under general heads. In seeking information on a specific subject, it will be well to look through the abstracts under the most suitable heading, and also to look through those under other headings. For example, some of the heating articles also contain information on air conditioning, and vice versa, as the grouping has been made on the basis of the subject most prominently covered in the article.

The index to the Journal Section of the American Society of Heating and Ventilating Engineers is separate (see page 777).

This index does not include Equipment Developments; Useful Information; Trade Literature; Coming Events—departments appearing regularly each month. The Editor's Pages in each issue include items of news, comments on current events, etc. In the January issue a complete directory section was published covering heating, piping and air conditioning equipment for industry and large buildings.

Air Conditioning

Air Conditioned Blast Furnace, The
Vol. 14, No. 2. February, 1942. p. 99

(Abstract of an article); benefits obtained by equipping one of blast furnaces at Aliquippa works of Jones & Laughlin Steel Corp. with chilled water air conditioning system; iron production increased and coke consumption decreased; steam saving more than offset operating cost of air conditioning unit; greater percentage of maximum tonnage that can be expected will be produced using three grain system.

Air Conditioned Chemistry Laboratory Does Its Part in Winning the War, by Lester T. Avery
Vol. 14, No. 5. May, 1942. p. 295

Air conditioning and ventilating problems in a chemistry laboratory; description of new laboratory at Columbia Chemical Div., Pittsburgh Plate Glass Co.; temperatures and humidities required; exhaust hoods; mechanical refrigeration unit and silica gel combined allow wide range of temperatures and humidities; flow diagram for air conditioning system; pneumatic control; how "anticipating" thermostat prevents hunting of control system; importance of temperature and humidity recorder.

Air Conditioned Inspection Room
Vol. 14, No. 5. May, 1942. p. 294

Illustration of air conditioned inspection room at Atlas Ball Div., SKF Industries; reason for air conditioning room.

Air Conditioned Plant Restaurants Keep Busy War Workers Up to Par, by Samuel R. Lewis
Vol. 14, No. 5. May, 1942. p. 279

Unusual plant restaurant of Chicago Bridge & Iron Co. built of curved steel sheets arc welded; method of construction; insulation sprayed on; air supply duct; grilles; direct radiators; oil fired boiler supplies hot water for heating; direct expansion "Freon" refrigeration system; air supply intakes and exhaust outlets; induced draft fan with automatic time switch.

Air Conditioning Boosts Optical War Goods Production, by Logan Lewis
Vol. 14, No. 7. July, 1942. p. 407

(War Problems Forum); optical instruments industry finding air conditioning valuable production tool; four major categories in which air conditioning is serving this industry; examples.

Air Conditioning—for Offense—Assures Uninterrupted Production of War Material
Vol. 14, No. 4. April, 1942. p. 226

Photographs and brief description of huge windowless air conditioned manufacturing plant for production of war equipment; plant is air conditioned because of need for uninterrupted production at fastest possible rate; raising two large fans into position; typical air conditioning platform supported by trusses above assembly bay; special booster coils in ducts above door openings and sections around outer walls; hoods for outside air intake and exhaust equipment with special light traps; special ventilation for convenience facilities areas.

Air Conditioning to Increase Production of Silvery Pig Iron
Vol. 14, No. 4. April, 1942. p. 232

(War Problems Forum); increasing production of iron and steel industry by air conditioning for supplying dry blast to blast furnaces; contract awarded by Jackson Iron and Steel Co. for air conditioning high silicon content iron producing furnace; importance of such an installation to war effort; centrifugal turbine driven refrigeration machine to be used.

Air Conditioning Speeds Torpedo Boat Production
Vol. 14, No. 7. July, 1942. p. 429

60 ton air conditioning system cools administrative, drafting, training, and personnel offices at a Southern plant producing P-T torpedo boats; air conditioning essential, particularly in drafting room on top floor.

Air Conditions for Precision Gages, by C. L. Roberts
Vol. 14, No. 3. March, 1942. p. 160

(Excerpt from an article); air conditions for constant temperature room for finishing precision gage blocks at Pratt and Whitney plant; importance of exact control of dry bulb temperature; need for constant relative humidity; method of control.

Air Discharge from Narrow Slots, by H. M. Hendrickson
Vol. 14, No. 1. January, 1942. p. 23

("Open for Discussion"); comment on articles by F. F. Stevenson in May and June, 1941, issues of HPAC and remarks by Prof. J. R. Fellows and D. W. Nelson in September, 1941, HPAC; formula for throw of air; limitations of formula; economic aspect of narrow slots versus grilles for industrial air conditioning; advantages of slots; method of adjusting slot height; turning vanes; sketches showing construction of adjustable slot.

Air Filters Cover Entire Ceiling of Production Paint Shop
Vol. 14, No. 7. July, 1942. p. 428

Straight line production methods used at recently completed paint shop at one of the Westinghouse Electric & Mfg. works; switchgear panels and switchboards brought in for painting on flat top trucks which run on tracks through paint shop; ventilating air drawn through ceiling; 180 wire mesh washable filters; paint spray carried downward through open grille work in floor where it is deposited on water surface; total air exhausted about 200,000 cfm.

Air in Air Raid Shelters, by Walter L. Fleisher
Vol. 14, No. 7. July, 1942. p. 413

Excerpts from Brackett lecture delivered at Princeton University; importance of supplying proper air quantities to maintain correct temperatures and humidities in air raid shelters; carbon dioxide content of air; combined multiple story garages and air raid shelters suggested; advantages of such shelters; sketches showing plan, elevation, and roof construction. (See discussion on pp. 473-474, August issue).

Air in Air Raid Shelters
Vol. 14, No. 8. August, 1942. p. 473

("Open for Discussion"); discussion by John K. Peebles, Jr., of article by Walter L. Fleisher on air in air raid shelters published in July HPAC; temperature rise in shelters; British standards for maximum number of persons in shelter; shelter construction; additional comments by Mr. Fleisher.

Air in Contact with Water, by William Goodman
Vol. 14, No. 3. March, 1942. p. 169

Analyzing air conditioning and heat exchange processes with psychrometric chart; air films on water surfaces; "straight line" principle; equilibrium water temperature; adiabatic processes; psychrometric chart for temperature range from 20 to 120 F.

Air in Contact with Water, by William Goodman
Vol. 14, No. 4. April, 1942. p. 237

Equilibrium water temperature in nonadiabatic straight line processes; final condition of air; change in state of air in contact with water whose temperature varies; limiting final water temperature; method of constructing condition curves for parallel flow and counterflow of air and water; condition curves for various values of ratio of weight of air supplied to weight of water evaporated.

Air in Contact with Water, by William Goodman
Vol. 14, No. 5. May, 1942. p. 299

Analyzing air conditioning and heat exchange processes with psychrometric chart; heating and humidifying with water whose temperature varies; cooling and humidifying with water whose temperature varies; cooling and dehumidifying with water whose temperature varies; parallel flow and counterflow; condition curve when air is cooled by water inside of coil and initial portion of coil is dry.

Aircraft Engines Breathe Conditioned Air While on Test
Vol. 14, *No.* 7. *July,* 1942. *p.* 405

(War Problems Forum); excerpts from paper presented by C. A. Chayne at Midwest Power Conference describing the testing and running in of aircraft engines; feed back system; test cells; conditioned air supplied test cells.

Blaze in Retail Store's Air Conditioning System Gives Fire Safety Data
Vol. 13, *No.* 12. *January,* 1942. *p.* 212 (*back section*)

Recommendations for eliminating fire hazards in air conditioning systems based on observations after fire in Tiedtke retail store, Toledo, Ohio; brief description of installation; air filtering equipment; cause of fire unknown; importance of accessibility of equipment, automatic dampers, fine screening at duct openings, cleaning of ducts, and use of sprinklers.

Can Ceiling Outlets Kayo Ceiling Smudge?, by G. F. Nightingale
Vol. 14, *No.* 1. *January,* 1942. *p.* 24

("Open for Discussion"); comment on remarks of F. F. Espenschied published in December, 1941, HPAC; supply air is mainly guilty for ceiling smudge; importance of good air filters.

Charles E. Wilson Elected ACRMA President
Vol. 14, *No.* 7. *July,* 1942. *p.* 409

New officers elected by the Air Conditioning and Refrigerating Machinery Association, Inc.

Chemical Conditioning System for Independent Humidity Control, by E. A. Windham
Vol. 14, *No.* 1. *January,* 1942. *p.* 25

Well water for cooling in summer and independent control of humidity by chemical conditioning system feature air conditioning at defense plant; chemical conditioning system comprises four units; air circulation; control during summer and winter operation; effect of relative humidity; flow diagram; cost of installation; views of chemical conditioning equipment.

Chemical Moisture Control System to Improve Blast Furnace Operation
Vol. 14, *No.* 4. *April,* 1942. *p.* 231

(War Problems Forum); contract awarded for lithium chloride moisture control system for furnishing dry blast to new blast furnace of Republic Steel Corp.; amount of air to be treated; furnace capacity to be increased; other installations; diagram of chemical moisture control system for foundry cupola.

Coding Chart Simplifies Handling of PD-1A Forms
Vol. 14, *No.* 6. *June,* 1942. *p.* 351

(War Problems Forum); coding chart prepared by Air Conditioning and Refrigerating Machinery Association with informal collaboration of officials of air conditioning in commercial refrigeration branch of WPB; shows ultimate buyer or users of facility or end product, manufacturing industry or business classification, and application or functional use of refrigeration and/or air conditioning equipment; explanation of use of chart.

Completely Conditioned Manufacturing Building Has Fifty-One Separate Zones, by J. Thomas Browne and Raymond C. Carlson
Vol. 14, *No.* 8. *August,* 1942. *p.* 467

Wartime manufacturing building air conditioned throughout; reinforced concrete construction with glass block windows; refrigeration capacity; air circulation; 10 in. pipe lines for chilled water; turbine driven centrifugal "Freon" compressor; use of well water to supplement compressor; aspirating air diffusers; air conditioning units; ducts; cooling and ventilation for plating department; exhaust fans; pneumatic controls; conditions maintained; resistance thermometer for reading wet and dry bulb temperatures; other instruments.

Compressors to Be Taken for War Plant Use
Vol. 14, *No.* 10. *October,* 1942. *p.* 606

Air conditioning compressors in sizes 100 hp and larger to be taken from various types of buildings for use in war production.

Consider Evaporative Cooling for Blackout Plants, by Walter L. Fleisher
Vol. 14, *No.* 1. *January,* 1942. *p.* 28

Importance of control of air conditions in industrial plants; refrigeration tonnages used; electrical, water and refrigerant requirements per ton of refrigeration; cooling towers; author's opinion is that consideration should be given to evaporative cooling as practical substitute for complete air conditioning of factories; effective temperatures; average internal sensible heat load; amount of air circulation required; ASHVE comfort chart for air velocities of 15 to 25 fpm.

Control of Air Flow Vital in Alloy Steel Lab
Vol. 14, *No.* 7. *July,* 1942. *p.* 408

(War Problems Forum); method of heating and ventilating new chemical laboratory building at Vanadium Corp. of America; positive pressure maintained; large amount of air handled b hoods; hood design; importance of atmospheric control.

Defend the Defense Worker
Vol. 14, *No.* 1. *January,* 1942. *p.* 226 (*back section*)

Abstracts of papers presented at annual meeting of Industrial Hygiene Foundation; exhaust ventilation; welding fumes; sabotage precautions; industrial hygiene at work; manufacture of bulletproof gasoline tanks; ventilation in magnesium foundries; solvent vapor exposure; painting luminous dials.

Double Duct Air Conditioning System Meets Individual Room Requirements, by James N. Livermore
Vol. 14, *No.* 2. *February,* 1942. *p.* 91

Description of air conditioning system for general offices building of Detroit Edison Co.; numerous room coolers presented servicing and maintenance problem; extensive partition changes made it opportune to install central air conditioning; unsatisfactory experiences with zoning; excellent performance of double duct system, one carrying warm air and the other cold air; description of double duct system; duct construction; especially designed mixing dampers controlled by pneumatic room thermostats; requirements for mixing dampers to obtain good temperature control; damper control; room air diffusers of two types, neither conventional; perforated metal acoustic ceilings; slotted duct diffusers, arrangement of equipment in fan room, variable speed hydraulic couplings; flooding nozzles installed to reduce air to saturated condition; temperature control; central refrigeration plant chills water.

Drying of Foods, The, by W. R. Marshall, Jr.
Vol. 14, *No.* 9. *September,* 1942. *p.* 527

War creates tremendous demand for dried foods to save shipping, and storage space and prevent spoiling; food drying problems; preparatory processes for fruits and vegetables; reasons for drying foods; reduction in weight of vegetables by drying; illustrations of dried carrots, potatoes, beets, and chicken, with moisture content, temperature, and drying time data; general characteristics of food drying; drying terminology; temperatures; initial and final moisture contents; form of food for drying; appearance of dried foods; references. (Additional data on p. 658, November issue).

Drying of Foods, The, by W. R. Marshall, Jr.
Vol. 14, *No.* 10. *October,* 1942. *p.* 588

Methods of drying; drying equipment; classification of dryers; types of dryers suitable for foods; method of operation; supporting and transporting material; type of material handled; method of transferring heat to wet food; capacity range; energy consumption; dryer performance; references.

Drying of Foods, The, by W. R. Marshall, Jr.
Vol. 14, *No.* 11. *November,* 1942. *p.* 671

Food drying fundamentals; dryer design; material balance; heat balance; drying time curve; drying rate curve; equations; references.

Drying of Foods, The, by W. R. Marshall, Jr.
Vol. 14, *No.* 12. *December,* 1942. *p.* 724

Analysis of typical data for drying various foods; drying curves for potatoes, carrots, beets, and ground beef; effect of air temperature and humidity; effect of method of preforming; effects of other variables on drying time; falling rate period; table showing drying data on fruits, vegetables, and other foods; references.

Fan Laws—Arranged for Ready Reference, by William Goodman
Vol. 14, *No.* 11. *November,* 1942. *p.* 652

Summary of equations for figuring fan performance originally given in articles in August, September, and October issues, effects of speed changes, diameter changes, density changes, etc.

Fan Laws—Their Derivation and Use, by William Goodman
Vol. 14, *No.* 8. *August,* 1942. *p.* 487

Importance of a thorough understanding of fan laws which relate the various performance characteristics of fans; selection of fans for most efficient operation; similar fans; typical fan performance and efficiency curves; corresponding points; effect of variations in air quantity; effect of variations in pressure; variation in horsepower; two quantities determine fan performance; performance curves for fans; fan laws and methods of deriving them.

Fan Laws—Their Derivation and Use, by William Goodman
Vol. 14, *No.* 9. *September,* 1942. *p.* 535

Computing multirating tables of fan performance; equations and examples; operating point of a fan; volume of air to be delivered, effect of changes in fan speed; change of fan speed to obtain delivery of required weight of air; pressure when fan speed is changed to obtain delivery of required weight of air.

Fan Laws—Their Derivation and Use, by William Goodman
Vol. 14, *No.* 10. *October,* 1942. *p.* 617

Change in horsepower with change in speed and density; change in pressure with change in density at constant fan speed; friction loss in ducts; how to apply fan laws when densities of air in duct and fan are different.

Fight for the Ceiling, The, by Knight C. Porter
Vol. 14, *No.* 8. *August,* 1942. *p.* 484

Essential that interests of air conditioning engineer, lighting engineer, and acoustical engineer be coordinated; amount of air required to handle lighting load; lighting intensities with various types of fixtures; characteristics of fluorescent lighting; room temperatures for maximum efficiency of fluorescent lighting; acoustical treatment of offices; amount of ceiling area required by air conditioning outlets, lighting fixtures, and acoustical treatment. (See discussion on p. 550, September, 1942, HPAC).

Fight for the Ceiling, The
Vol. 14, *No.* 9. *September,* 1942. *p.* 550

("Open for Discussion"); comments of C. H. Randolph and Howard M. Sharp on article by Knight Porter (published in the August, 1942, HPAC) discussing relationship between air conditioning, illumination, and acoustical control; difficulty in establishing lighting load; use of fluorescent lighting; interference with air stream by lighting fixtures; heat gain from lighting; lighting levels.

Fire Protection Association Amends Rules on Air Conditioning and Welding
Vol. 14, *No.* 7. *July,* 1942. *p.* 409

Amendments to standards for installation of air conditioning equipment adopted by NFPA at annual meeting; thickness of metal for ducts; fusible links for fire doors and dampers; smoke dampers; electric lamps; temperature protection devices for motors; photoelectric smoke dampers; revised standards governing installation and operation of gas systems for welding and cutting adopted; standards revised for foam and carbon dioxide extinguishing systems.

Fume Control in Foundries a Vital Wartime Ventilation Job, by Bernard G. Silberstein
Vol. 14, *No.* 11. *November,* 1942. *p.* 659

Sixteen propeller fans solve smoke and fume problem in busy foundry; importance of ventilation; size of building; air change; results.

Functional Uses of Air Conditioning and Refrigeration as Related to the War Effort
Vol. 14, *No.* 10. *October,* 1942. *p.* 613

Listing of functional uses of refrigeration and air conditioning as related to the war effort compiled by Air Conditioning and Refrigerating Machinery Association.

High Velocity Air Circulation in Armories, by John C. Ross
Vol. 14, *No.* 4. *April,* 1942. *p.* 228

("Open for Discussion"); comment on article describing new Patten Memorial gymnasium of Northwestern university published in January, 1942, HPAC; origin of this method of heating and ventilating.

Highlights of Detroit Edison's Air Conditioning Health Survey, by Henry S. Walker
Vol. 14, *No.* 11. *November,* 1942. *p.* 677

Fifteen hundred employees cooperate in measuring health aspects of air conditioning; groups in non-air conditioned and air conditioned office buildings studied; respiratory infections; rate of dust accumulation; bacteria; temperature; humidity; pollen counts; the weekly health questionnaire used in the study.

How a Hotel Chain Maintains Its Air Conditioning Systems, by H. W. Genone
Vol. 14, *No.* 6. *June,* 1942. *p.* 345

Tonnage of air conditioning in use at the seven Dinkler hotels; public space air conditioning; bedrooms; individual air conditioning units; chilled water and hot water piping; maintenance of air conditioning installations; methyl chloride substituted for "Freon" on some jobs; air conditioning installation at Ansley roof garden, Atlanta, Ga.; importance of air diffusion.

How Air Conditioning Aids the War Effort, by Margaret Ingels
Vol. 14, *No.* 9. *September,* 1942. *p.* 543

(War Problems Forum); brief paragraphs giving examples of air conditioning applications for war; testing radio parts; production of tracer bullets; preventing meat shrinkage; central air conditioning system for oil company offices; zoning.

How Ducts Are Made of Substitute for Sheet Metal, by T. M. Cunningham
Vol. 14, *No.* 10. *October,* 1942. *p.* 585

Use of sheet board materials for ventilating and air conditioning duct construction; amount of metal saved on one job; duct sizes; factors to consider; thicknesses; duct design; friction; materials used; sheet metal slip joints; fabrication; duct fittings; hangers; access doors; branch connections; use of sealing compound; some types of air outlets require sheet metal collar.

How to Figure Duct Sizes, by William Goodman
Vol. 14, *No.* 2. *February,* 1942. *p.* 107

New duct sizing chart combines latest data for sizing both round and rectangular ducts; friction losses based on recent ASHVE laboratory tests on ducts with 40 joints per 100 ft.; advantages of showing both round and rectangular ducts on one chart; examples of how to use chart; square ducts; aspect ratios; ratios for computing equivalent round ducts; air density and its effect on performance of fans and other equipment; formula for correcting speed of fan for air other than standard; formula for obtaining pressure loss that will be obtained when nonstandard air is flowing through a duct.

How to Figure Duct Sizes, by William Goodman
Vol. 14, *No.* 3. *March,* 1942. *p.* 172

Supplement to article published in February, 1942, HPAC, showing development of equations used in computing chart for determining pressure loss due to friction in ducts.

How to Make Full Use of All Motor Horsepower, by A. C. Streamer
Vol. 14, *No.* 11. *November,* 1942. *p.* 670

(War Problems Forum); importance of conserving materials used in motors and loading each motor to the limit; six recommendations for making full use of motor horsepower; sleeve bearings; standard speeds; alternating current preferred to direct; control and circuit protective equipment.

How to Save Critical Metals in Specifying Non-Spark Fans, by E. P. Heckel
Vol. 14, *No.* 4. *April,* 1942. *p.* 229

(War Problems Forum); importance of using non-spark fans where air contains a mixture of alcohol or other high volatile chemicals; non-ferrous wheels fabricated of copper or aluminum; instead of using complete non-ferrous wheel assembly, a copper or aluminum ring is secured to inside surface of fan inlet sheet in order to conserve scarce materials.

Humidity Control in Underground Bombproof Spaces, by Edward Ledoux
Vol. 14, *No.* 1. *January,* 1942. *p.* 6

Importance of passive defense as assured by bombproof construction; design, construction and equipment of underground spaces; importance of wall evaporation as source of moisture; construction details which reduce air conditioning load; effect of temperature on evaporation of moisture; effect of dew point; use of adsorption principle for conditioning such spaces.

Humidity Control in Underground Bombproof Spaces, by Edward Ledoux
Vol. 14, *No.* 6. *June,* 1942. *p.* 364

Discussion of mechanism of wall evaporation in underground spaces and numerical examples illustrate importance of this factor; wet bulb temperature; adiabatic operation; required air conditioning capacity; effect of "natural temperature" of the space; calculations illustrated on psychrometric charts.

Ideal Blackout Factory Envisioned by Construction Expert
Vol. 14, *No.* 10. *October,* 1942. *p.* 596

(War Problems Forum); George H. A. Parkman describes ideal war factory, a blackout, bomb resistant, windowless building; use of electric air cleaners; use of sterilizing lamp; concrete eggshell construction.

Industrial Health Defense—Dust Counts and Their Significance, by N. R. Bernz
Vol. 14, *No.* 3. *March,* 1942. *p.* 173

Methods employed in evaluation of dust exposures; types of sampling and counting instruments; Greenburg-Smith impinger; Sedgwick-Rafter and Hatch counting cells; microscopic setup, errors when using various techniques.

Industrial Health Defense—Dust Counts and Their Significance, by N. R. Bernz
Vol. 14, *No.* 6. *June,* 1942. *p.* 361

The midget impinger; evaluation of dust samples; dilution required; microprojector; making dust counts with microprojector; discussion of accuracy; Owens jet; Bausch & Lomb dust counter; konimeter; dust counting procedures.

Industrial Health Defense—How to Make Dust Counts, by N. R. Bernz
Vol. 14, *No.* 10. *October,* 1942. *p.* 603

Summary of methods of calculation for various dust counting instruments, with multiplication factors; choice of dust counting and sampling method; purpose of dust counts; the microscope, the sample; other factors; what to include in dust count reports in industrial hygiene surveys.

Industrial Plant Air Conditioning—How Operation and Maintenance Are Organized at Air Conditioned Plant
Vol. 14, *No.* 1. *January,* 1942. *p.* 15

Description of organization of operation and maintenance force for the air conditioning equipment at a defense plant using 3,200 tons of mechanical refrigeration and well water pre-chilling equipment; operating personnel divided into two classes—one group of operators responsible for equipment which maintains proper water temperature, second group of operators responsible for air handling units; operating logs and charts; standardization of controls; function of controls; air conditioning penthouse check sheet; control settings change notice sheet; provisions for safety; electrostatic air cleaners; card index file kept on all maintenance schedules; cleaning electrical precipitator air filters; preventive maintenance given extensive consideration; complete stock of replacement parts; large belt board for extra drive belts; fire routine followed in event of emergency.

Industry Committee Presents Report on "Freon" Refrigerants to the OPM
Vol. 14, *No.* 1. *January,* 1942. *p.* 9

Comprehensive report on "Freon" refrigerants submitted to OPM by subcommittee No. 8 of the air conditioning and refrigeration industry; committee personnel; scope of report; "Freon" conservation program recommended; general substitution of other refrigerants for "Freon" should not be required; amount of carbon tetrachloride which should be allotted for manufacture of refrigerants; what can be done to conserve "Freon" in air conditioning and refrigeration industry.

Installation and Service Instructions for Refrigeration Condensing Units
Vol. 14, *No.* 9. *September,* 1942. *p.* 556

Proposed commercial standard for commercial electric refrigeration condensing units gives installation and service instructions; air cooled and water cooled units from ⅛ to 3 hp and water cooled models of 5 hp covered. (See discussion on p. 660, November issue).

L-38 Bans Air Conditioning Except for Essential Uses
Vol. 14, *No.* 6. *June,* 1942. *p.* 37 (*front section*)

Limitation order L-38 of War Production Board bans new installations of air conditioning and commercial refrigeration equipment, except to meet war and essential civilian requirements; installations designed solely for personal comfort are out; various provisions of order; uses of equipment which will be deemed essential by WPB air conditioning and commercial refrigeration branch.

Limitation Order L-38 Recently Amended
Vol. 14, *No.* 11. *November,* 1942. *p.* 656

Production of additional types of air conditioning and commercial refrigeration equipment prohibited by amended order L-38; production of evaporative coolers restricted.

M-219 Restricts Silica Gel
Vol. 14, *No.* 11. *November,* 1942. *p.* 670

War Production Board order M-219 limits use and delivery of silica gel; preferred uses.

Man Behind the Man Behind the Man Behind the Gun—the Air Conditioning Engineer, The, by F. O. Jordan
Vol. 14, *No.* 4. *April,* 1942. *p.* 220

Necessity of air conditioning war production plants; heat gains in machine shops; comfort air conditioning in engineering departments and plant office buildings; description of air conditioning main factory building at aircraft engine plant; calculating cooling load; sun effect; use of sun screen on office windows; 6,000 tons refrigeration capacity; various schemes of refrigeration considered; five 1,200 ton centrifugal refrigerating units driven by steam turbines; water temperatures; cooling tower; hot water circulated for heating through same piping which delivers chilled water; control methods; office and engineering sections of another plant have all-year air conditioning while factory portions are cooled by means of outside air; refrigeration load; nine separate direct expansion systems; reciprocating compressors; evaporative condensers; roof ventilators; method of air introduction; cfm per sq ft of floor area.

"Man Is an Air-Animal"
Vol. 14, *No.* 9. *September,* 1942. *p.* 541

Excerpt from book "Storm," by George R. Stewart, which shows the very great effect of air upon man, his life, and his activities.

Measurement of Water Vapor and Gases
Vol. 14, *No.* 8. *August,* 1942. *p.* 480

Authors of technical paper presented at annual meeting of American Society for Testing Materials awarded Charles B. Dudley medal; paper describes work in developing precise laboratory method and field method for estimating moisture in fuel gases.

Method of Limiting Electric Power Use
Vol. 14, *No.* 4. *April,* 1942. *p.* 232

(War Problems Forum); method of curtailing use of electric power illustrated by War Production Board's limitation order L-46; provisions of order.

Modern Ventilation Makes Blackout Plants Possible, by F. O. Jordan
Vol. 14, *No.* 10. *October,* 1942. *p.* 621

Description of airplane manufacturing plant designed to be blacked out; ventilation problem intensified in blackout factory; motor driven supply and exhaust ventilators in roof; projection unit heaters; method of heating at open doorways with blower type unit heaters; steam supply; factory boiler plant; feedwater heater; process steam; compressed air; hot water requirements.

Moisture Pick-Up Data for Drying by Hot Air, by W. R. Marshall, Jr.
Vol. 14, *No.* 11. *November,* 1942. *p.* 658

("Open for Discussion"); answer to reader's question on amount of moisture pick-up per cubic foot of air at various temperatures and humidities; moisture pick-up a function of several factors; air flow; air temperature; construction and insulation of dryer; table showing exhaust air temperatures relative humidities, dew points, and absolute humidities.

New Plant for Fluorescent Lamp Production
Vol. 14, *No.* 3. *March,* 1942. *p.* 162

Photographs and brief description of new Hygrade Sylvania Corp. fluorescent lamp plant; concrete pipe used for ducts, ventilating system; piping facilities; exhaust; pump room.

New Windowless Plant to Have Lake on Roof
Vol. 14, *No.* 3. *March,* 1942. *p.* 168

Ground broken for new factory edition for Monroe Calculating Machine Co.; four story windowless air conditioned building; roof to be covered with 3 in. layer of water.

Noise Levels, by John S. Parkinson
Vol. 14, *No.* 3. *March,* 1942. *p.* 161

("Open for Discussion"); brief comment on article on noise levels by William Goodman in December, 1941, HPAC; always necessary to consider all sources of approximately equal intensity if substantial reduction in noise level is desired.

Operating and Maintenance Engineers Have Vital Job to Do in Wartime, by Lester S. Ries
Vol. 14, *No.* 8. *August,* 1942. *p.* 471

Maintenance organizations at institutional and other buildings must give increased attention to equipment in their charge; certain principles should be followed to interfere least with war effort; assuring uninterrupted operation of ventilating equipment; electrical maintenance; conservation of supplies and services; inspection and cleaning of ventilating fan; inspection of air washers.

Operating Room Air Cleaned Electrically
Vol. 14, *No.* 8. *August,* 1942. *p.* 474

Brief description and illustration of application of electrostatic precipitation for cleaning ventilating air in operating rooms of 250 bed hospital; four 25 ton compressors for cooling.

P-126 Gives High Priority Ratings for Air Conditioning Repairs
Vol. 14, *No.* 5. *May,* 1942. *p.* 289

(War Problems Forum); preference rating order P-126 issued by War Production Board grants high preference ratings for materials needed for repairs to air conditioning and refrigerating equipment; various ratings which will be assigned; statement of J. M. Fernald on administering order.

Plants Install Ventilation for Wartime Blacking Out, by Leo Hungerford
Vol. 14, *No.* 2. *February,* 1942. *p.* 117

Pacific coast defense plants operating 24 hr a day needed additional ventilation on outbreak of war; principal consideration has been speed of installation; three of the methods used; blowers discharge through upper sections of windows; blowers placed at intervals in vertical sections of saw toothed building; evaporative cooling combined with ventilation; special conditions to be considered in ventilation of blackout plants.

Power Shortages
Vol. 14, *No.* 6. *June,* 1942. *p.* 366

War Production Board issues order L-94 to handle power shortages wherever and whenever they occur.

Practical Application of Recent Developments in Theory to Air Conditioning Design Problems, by William Goodman
Vol. 14, *No.* 12. *December,* 1942. *p.* 730

Advantages of basing air conditioning designs on rational basis; use of psychrometric chart; heat gains and heat losses in rooms; sensible heat percentage line; selecting condition of air supply; elements of coil action; air mixtures; condition curve on psychrometric chart.

Precise Weather Needed for Precision Work, by W. S. Bodinus
Vol. 14, *No.* 9. *September,* 1942. *p.* 544

Necessity of air conditioning laboratory for manufacture of precision measuring instruments; length standards; checking sizes by optical methods; underground laboratory maintained at 69 F and 40 per cent relative humidity; spray type air conditioning equipment supplies 4,000 cfm; intricate system of duct work; diffusion outlets; air cleanliness of utmost importance.

Predicting Dust Concentration, by Frank B. Rowley and Richard C. Jordan
Vol. 13, *No.* 12. *January,* 1942. *p.* 19

Equations for predicting dust concentration in enclosed spaces when continuous or intermittent filtering of the air is employed, given in December, 1940, February, 1941, and May, 1941, issues of HPAC; examples of applications of equations to practical problems; factory dust control; same equations can be used to determine concentrations of gaseous or particulate contaminants; use of equations in calculating bacteria content of air with air washers using untreated water and with the addition of a germicide: effect of intermittent and continuous filtered air circulation on dust content in a building; table showing frequency distribution and calculated settling velocities for air borne foundry dusts.

Refrigeration for Comfort Conditioning to Be Drafted for Essential Production, by E. P. Heckel
Vol. 14, *No.* 11. *November,* 1942. *p.* 650

Advantages of using existing machines for war production rather than new ones; importance of securing original drawings and expert superintendent; how removal will affect present owner; estimate of amount of refrigeration required for synthetic rubber production; pictures illustrating synthetic rubber manufacture.

Refrigeration Unit for Shock Testing at Ordnance Plant, by R. C. Lindblom
Vol. 14, *No.* 11. *November,* 1942. *p.* 669

(War Problems Forum); shock testing equipment designed and built by air conditioning dealer for ordnance plant; shock testing 37 mm shot before inspection; insulated tanks for chilled and hot water; 5 hp condensing unit; drinking water coil installed in bottom of cold water tanks.

Reinforced Concrete Pipe Used for Underfloor Air Ducts at New Plant, by S. M. Brown
Vol. 14, *No.* 5. *May,* 1942. *p.* 282

New fluorescent lamp plant of Hygrade Sylvania Corp.; amount of air necessary; use of reinforced concrete pipe for air ducts; pipe sizes; method of taking off branch lines from main runs; sheet metal ducts for second floor; air washing and handling system; advantages of using concrete pipe; partial plan view of duct layout.

Releasing Refrigeration for War Production, by A. J. Lawless
Vol. 14, *No.* 11. *November,* 1942. *p.* 649

Loss of one-third to one-half refrigeration capacity may not seriously affect usefulness of system; ventilation; evaporative cooling; movement should be promoted on local basis.

Removal of Refrigeration Equipment from Existing Comfort Conditioning Systems for Use in War Production, by A. E. Vroome
Vol. 14, *No.* 11. *November,* 1942. *p.* 647

Disconnecting, removing and re-installing refrigeration equipment; interested parties; purchaser; supervising engineer; contracts and agreements; suggested clauses; dismantling equipment; partial operation of air handling system after removal of refrigerating plant; protection of equipment if shut down; partial air conditioning; spaces which definitely require air conditioning; re-installation of refrigerating machines for war industry; plan to remove refrigerating equipment for use in war production proves importance of air conditioning, according to Dr. Carrier.

Romance of Outstanding Industries, The
Vol. 14, *No.* 4. *May,* 1942. *p.* 39 *(front section)*

Radio script for Pan American broadcast on conquering the temperature; applications and advantages of air conditioning; air conditioning in wartime.

Save . . . Simplify . . . Substitute
Vol. 14, *No.* 6. *June,* 1942. *p.* 355

Report of two day "all industry conference of the air conditioning and refrigeration industry" held in Chicago; refrigeration and air conditioning industry's "program for victory" presented by Dr. William R. Hainsworth; text of program which promotes saving, simplifying, and substituting; alternative materials in air conditioning and refrigeration field; critical position of our material supply; functions of jobber and wholesaler; functions of air conditioning and commercial refrigeration branch of WPB; availability of "Freon"; cylinder shortage; importance of air conditioning and refrigeration equipment to wartime production emphasized by A. B. Schellenberg; world peace after war can be assured by raising standard of living of all peoples of the earth.

Silica Gel Dehydrators Speed Shell Loading
Vol. 14, *No.* 8. *August,* 1942. *p.* 477

(War Problems Forum); installation of silica gel dehydrators at southern ordnance plant reduces time gap between powder and ultimate shell loading; equipment comprises two rotary dehydrators, and two 4-compartment dryers; humidity 5 per cent or less.

Solar Heat Gain Through Frosted and Plain Glass, by F. G. Hechler
Vol. 14, *No.* 3. *March,* 1942. *p.* 161

("Open for Discussion"); additional comment on information on solar heat gain through glass published on p. 575, September, 1941, HPAC, and p. 753, December, HPAC; test data comparing solar heat transmitted by various materials; method of making tests; temperature and heat flow data on reference panel, clear glass and frosted glass.

Specialties
Vol. 14, *No.* 6. *June,* 1942. *p.* 366

Schedule No. VIII to WPB limitation order L-42 requires simplification of vacuum and vapor heating specialties, including traps, strainers, and valves.

Steel for Battleships by Conditioning Blast Furnaces
Vol. 14, *No.* 7. *July,* 1942. *p.* 416

Enough extra steel every four months to build a battleship can be obtained by air conditioning a single blast furnace, according to Russell V. D. Dunne at a meeting of the ASRE; cost of dry blast equipment; time required to provide equipment; cost of building new blast furnaces; amount of steel required.

Steel Production Aided by Air Conditioned Crane Cabs, by Henry W. Moore
Vol. 14, *No.* 2. *February,* 1942. *p.* 111

Unusual application of air conditioning at steel company is cooling of two operator's cabs of cranes which handle steel ingots; temperatures encountered; with cooling, one operator now does work which formerly required three; cab temperature; enclosure of cabs; two way radio communication; air cooled condensing units; auxiliary condenser required because of high air temperatures; high temperature motors used; other special parts; some difficulty experienced with motors; vibration affects thermostatic control; application represents distinct contribution by air conditioning industry to war program for steel production.

Storage of Refrigeration a Method of Increasing Air Conditioning Capacity
Vol. 14, *No.* 4. *April,* 1942. *p.* 231

(War Problems Forum); storage of refrigerating effect offers air conditioning engineers method of overcoming priorities difficulties and increasing capacity of air conditioning system without increasing peak electrical demand, says C. J. Otterholm; how capacity of small system was increased; effect of flooding on heat transfer coefficient of cooling coil; storing refrigerating effect for cooling building prior to occupancy; method of control to avoid latent heat removal during precooling period; economic application of storage refrigeration depends primarily on electrical rate structure.

Testing for Methyl Chloride Leaks
Vol. 14, *No.* 11. *November,* 1942. *p.* 660

Halide torch should not be used for testing methyl chloride leaks, because of danger of explosion (see p. 556, September issue).

13,200 Tons of Air Conditioning for New War Department Building, by Margaret Ingels
Vol. 14, *No.* 11. *November,* 1942. *p.* 665

Brief description of new War Department building; size; architectural design; 12 centrifugal refrigeration machines; amount of air circulated; amount of condensing water; amount of chilled water; architects, engineers, and contractors.

Three-Zone Air Conditioning System Serves Shop, Offices, and Drafting Room, by T. H. Mabley
Vol. 14, *No.* 7. *July,* 1942. *p.* 401

Industrial building designed for protection against saboteurs and to facilitate blackout; windowless except for small light ports; central air conditioning system supplies three zones; three condensing units; oil fired direct air heater; control; air conditioning essential.

Treatment of Water for Air Conditioning, by C. M. Sterne
Vol. 14, *No.* 3. *March,* 1942. *p.* 176

Brief comment on proper chromate concentrations to carry in air washer and cooling tower water; hardness or quality of make up water an important factor.

Ventilating System Supplies 700,000 Cfm for Spray Painting Bomber Planes
Vol. 14, *No.* 11. *November,* 1942. *p.* 674

Brief description of spray painting structure for painting bombing planes; amount of air circulated; paint-air-water ratio; replaceable glass fiber air filters; duct work; exhaust units; entire system controlled by electric pushbuttons.

Ventilation for Control of Fumes in Wartime Welding Work, by W. C. L. Hemeon
Vol. 14, *No.* 6. *June,* 1942. *p.* 341

Necessity for electric welding fume control in shipbuilding and industrial plants; methods used; local exhaust; zone of suction or safety zone around end of hose; velocities and air quantities required; limitations of portable exhaust fans; specification for fume control; hose size; characteristics of various fans; excellent application for static regain; importance of ventilation service crews in shipyards; semi-portable fans; general ventilation; shop ventilation; floor welding; bench welding; measuring fume control; making suction measurement with U tube.

Ventilation for Ships Under Construction, by H. E. Packard
Vol. 14, *No.* 12. *December,* 1942. *p.* 711

Local exhaust of welding and burning fumes and carbon monoxide, general ventilation of compartments, and supply air masks for painters working in closed spaces required in shipbuilding; why both exhaust and supply air are required; tests show duct requirements; metal fume samples taken; metal duct construction; two types of fans used; ventilating the double bottoms; painting in enclosed compartments; why a ventilation engineer is needed; oxygen deficiency when men are working in small spaces.

Ventilation of Rotor Casting Department Given Special Attention by Motor Maker
Vol. 14, *No.* 7. *July,* 1942. *p.* 430

Enlarged rotor casting department at Reliance Electric & Engineering Co. transferred to separate building; casting molten aluminum; ventilating hood installed above casting presses; exhaust fans in wall; how ducts and hoods were arranged to allow chain hoist to pass back and forth freely; insulation used on enclosure for melting pots.

WPB's Air Conditioning Branch Consolidated
Vol. 14, *No.* 10. *October,* 1942. *p.* 622
War Production Board abolishes air conditioning and refrigeration branch, transferring it to general industrial equipment branch.

War Department Building Air Conditioned
Vol. 14, *No.* 8. *August,* 1942. *p.* 478
Illustration and brief description of air conditioning of new War Department building; pneumatic control; largest temperature control contract in history; air conditioning system; heat supplied by window radiators circulating hot water; consulting engineer and contractors.

Wartime Maintenance of Electric Control Equipment, by E. H. Alexander
Vol. 14, *No.* 10. *October,* 1942. *p.* 597
(War Problems Forum); importance of maintenance of electrical control equipment; circuit breakers or contactors; float switches; trouble shooting; care of copper and silver contacts; preventing coil burnouts; resistors; relays; temperature overload relays; time delay relays; what to do when there are corrosive fumes.

General

Allocation Classification System
Vol. 14, *No.* 8. *August,* 1942. *p.* 481
(HPAC data sheet); complete listing of new allocation classification symbols of the War Production Board; use became mandatory July 1; purchaser's symbols.

Army Develops Methods of Conserving Strategic Raw Materials
Vol. 14, *No.* 5. *May,* 1942. *p.* 287
(War Problems Forum); construction division of corps of engineers issues circular letter with recommendations for conservation of critical materials; prohibited uses of strategic materials in heating, piping or air conditioning systems; suggested list of substitutes; federal specifications for pipe.

Conservation of Critical Materials in Design
Vol. 14, *No.* 7. *July,* 1942. *p.* 405
(War Problems Forum); how designers can conserve critical materials discussed by Stephen F. Voorhees at Producers' Council Club of Washington; air conditioned office building for a war plant; too late to change or leave out air conditioning after design has been completed.

Conservation of Man Power to Increase War Production
Vol. 14, *No.* 4. *April,* 1942. *p.* 234
(War Problems Forum); Department of Labor has inaugurated program for conservation of manpower in war industries.

Copper Taboo for Buildings
Vol. 14, *No.* 12. *December,* 1942. *p.* 721
WPB issues amendment to conservation order M-9-c-4 restricting use of copper in buildings.

Directory Section of Heating, Piping and Air Conditioning Equipment for Industry and Large Buildings
Vol. 14, *No.* 1. *January,* 1942. *p.* 239 (*back section*)
Products classified, trade names and complete street addresses of manufacturers.

Eliminating the Week-End Blackout of Industrial Plants
Vol. 14, *No.* 1. *January,* 1942. *p.* 37
(HPAC data sheet); shift schedule for 168 hr week as used by Timken Roller Bearing Co.; schedule calls for three 8 hr shifts per day up to 40 hr per week, with each of the four crews working five extra shifts over a period of 20 weeks; every man works five days in a row and is then off at least 48 hr, after which he changes shifts; over each 20 week period each man has five Sundays off.

Emergency Repairs for Service Institutions
Vol. 14, *No.* 7. *July,* 1942. *p.* 408
(War Problems Forum); operators of theaters, hotels, restaurants and other service institutions should communicate with WPB field offices when emergency repair or maintenance materials are needed.

Enginemen Needed in Federal Buildings
Vol. 14, *No.* 9. *September,* 1942. *p.* 552
United States Civil Service Commission recruiting enginemen to be in charge of heating, refrigerating, and ventilating systems in federal buildings in Washington, D. C.

Extension of Ratings by Contractors Facilitated
Vol. 14, *No.* 4. *April,* 1942. *p.* 225
New War Production Board order P-19-h facilitates extension of preference ratings by building contractors.

Hazards to Eyes Increase
Vol. 14, *No.* 9. *September,* 1942. *p.* 556
Ninety-eight per cent of eye injuries which occur in American industries wholly unnecessary, according to study sponsored by the National Society for the Prevention of Blindness; new book discusses industrial hazards to vision.

How to Organize and Carry Out a Factory Scrap Campaign
Vol. 14, *No.* 10. *October,* 1942. *p.* 607
The salvage manager; surveying the plant; classification of scrap; promotion of the campaign; bins and containers; getting suggestions from workers; collection of scrap; house cleaning; conservation work; reports.

If It Hasn't Been or Won't Be Used for Three Months—Scrap It!, by Paul C. Cabot
Vol. 14, *No.* 11. *November,* 1942. *p.* 669
(War Problems Forum); amount of iron and steel scrap necessary; objectives of industrial salvage section of War Production Board; how industrial firms can cooperate.

Industrial Concern Conducts Salvage Campaign in Home Community
Vol. 14, *No.* 8. *August,* 1942. *p.* 476
(War Problems Forum); Lukens Steel Co., Coatesville, Pa., conducts salvage campaign; amount of materials collected; income from sale of salvaged materials could have covered all expenses; brochure describes campaign.

Industrial Health for Defense
Vol. 14, *No.* 9. *September,* 1942. *p.* 554
Massachusetts committee on public safety issues manual on industrial health for defense.

Industrial Salvage Program Launched
Vol. 14, *No.* 8. *August,* 1942. *p.* 475
(War Problems Forum); industrial salvage committee for machinery, instruments, and electrical equipment organized in New York; crucial need for scrap materials; sources of scrap.

Lubricants for Ball Bearings
Vol. 14, *No.* 3. *March,* 1942. *p.* 177
(HPAC data sheet); standards for relubricating ball bearings compiled by Annular Bearing Engineers' Committee; tabulation of greases for relubrication of bearings; ABEC grease testing machine and test procedure; lubrication of anti-friction bearings with oil.

New Allocation Classifications Simplify Priorities Procedure
Vol. 14, *No.* 7. *July,* 1942. *p.* 408
(War Problems Forum); uniform classification system enables War Production Board to trace flow of materials; allocation classification symbols; requirements embodied in priorities regulation No. 10.

Organized Maintenance Keeps Wheels of Industry Turning, by A. Heckman
Vol. 14, *No.* 8. *August,* 1942. *p.* 476
(War Problems Forum); maintenance department has vital responsibility in war effort; organization of maintenance department at main plant of Westinghouse Electric & Mfg. Co.; responsibilities of various divisions.

PD-1X to Simplify Distributor Priority Problems
Vol. 14, *No.* 4. *April,* 1942. *p.* 230
(War Problems Forum); new application form PD-1X issued by War Production Board simplifies priority problems of distributors, wholesalers and jobbers.

Pattern of Life Today—as Seen by One Engineer, The, by John Howatt
Vol. 14, *No.* 1. *January,* 1942. *p.* 34
Comments of the author on importance of research, mobilization of technical skill, business life in a seller's market, and need for relaxation to promote efficiency.

Priorities
Vol. 14, *No.* 1. *January,* 1942. *p.* 8
Division of priorities streamlines and simplifies regulations governing extension of preference ratings on small orders.

Priorities Picture, The
Vol. 14, *No.* 1. *January,* 1942. *p.* 5
New preference rating order P-100 takes place of old repair and maintenance order P-22; aids plants to obtain repair, maintenance and operating supplies; organizations who may use new order.

Priorities Picture, The
Vol. 14, *No.* 1. *January,* 1942. *p.* 18
All chlorine produced in United States subject to direct allocation; suspension orders issued against supply house for violation of priorities orders; two orders issued limiting use of chromium and chrome steel.

Priorities Picture, The
Vol. 14, *No.* 1. *January*, 1942. *p.* 27

Production requirements plan is new scheme for granting priority assistance to manufacturers engaged in essential production; supply houses furnishing materials and equipment to petroleum industry assigned preference rating; public utilities forbidden to undertake substantial expansion without express permission; number of preference rating orders issued for construction of defense housing dwelling units; importance of manufacturers cooperating with division of priorities; inventory and requisition section set up in OPM.

Purchasing Officers Needed for Civilian War Service
Vol. 14, *No.* 11. *November*, 1942. *p.* 670

Purchasing officers being sought by Civil Service Commission; duties; experience requirements.

Sales Engineering Firms Important to War Effort
Vol. 14, *No.* 9. *September*, 1942. *p.* 551

("Open for Discussion"); comments by A. Rust-Oppenheim on the important functions performed by manufacturers' agents or sales engineering organizations; improperly drafted bill to prevent payment of commissions and contingent fees for negotiation of war contracts could work great injuries on organizations which are performing real service.

Salvaging Scrap to Win the War, by Ray Schmidt
Vol. 14, *No.* 6. *June*, 1942. *p.* 352

(War Problems Forum); excerpts from talk made before Cleveland chamber of commerce on necessity of keeping scrap losses down; opportunities for salvage in both large and small plants.

School Children Teach Us a Thing or Two About Salvage, by John Howatt
Vol. 14, *No.* 12. *December*, 1942. *p.* 719

(War Problems Forum); Chicago schools conduct scrap metal salvage campaign; survey made of 400 school plants; amount of scrap collected by children.

Steel and Copper
Vol. 14, *No.* 6. *June*, 1942. *p.* 366

Conservation order M-126 issued by WPB forbids use of iron and steel in some 400 items; amendment to copper order prohibits use of copper and its alloys in over 100 items.

Subcontracting for War Production
Vol. 14, *No.* 3. *March*, 1942. *p.* 175

Booklet on subcontracting for defense; brief review of content.

Two Hundred Salvage Wardens Hunt Scrap
Vol. 14, *No.* 11. *November*, 1942. *p.* 668

(War Problems Forum); salvage wardens patrol workshops of Westinghouse Electric & Mfg. Co.; how scrap is reduced and salvaged; amount of scrap recovered.

WPB Bans Copper in Building Construction
Vol. 14, *No.* 8. *August*, 1942. *p.* 494

Use of copper and copper base alloy forbidden in building construction by conservation order M-9-c-4 issued by WPB; does not affect wiring; exceptions.

Wartime Conservation in the Office
Vol. 14, *No.* 8. *August*, 1942. *p.* 478

(War Problems Forum); procedures employed by a number of companies to inaugurate or intensify waste reduction programs outlined in report issued by Metropolitan Life Insurance Co.

Your Place in the "Smart Man's War," by George W. Meek
Vol. 14, *No.* 8. *August*, 1942. *p.* 463

Warfare requires most judicious use of resources; cost of killing a soldier in various wars; Donald Nelson has called World War II the "smart man's war"; field of conservation involves substitution, salvage, simplification, and specification; advantages obtained through each; field for conservation activities; good example of specification savings lies in practice of calculating ventilation requirements; ventilation air requirements for providing necessary oxygen content, preventing undue carbon dioxide concentration, and for removing objectionable body odors; savings in blackout aircraft assembly plant by reducing ventilation air; odor adsorbers; selection of type of heating system; weight comparisons for various types of heating systems; use of steel convectors; substitution; critical materials; redesign of unit ventilator to save steel and cast iron; elimination of tar coating on cast iron oil pipe and its advantages; simplification; water coolers simplified.

Heating

Analysis of Periodic Loads in Composite Walls, by B. F. Raber and F. W. Hutchinson
Vol. 14, *No.* 6. *June*, 1942. *p.* 367

(HPAC data sheet); graphical method of determining temperature at any point, for any time, in a homogeneous wall subject to periodic variation of outside air temperature (see April, 1942, HPAC) extended to composite walls; example illustrates procedure of setting up problem and carrying out graphical construction.

Bad Humidity Conditions Almost Brought Down the Roof, by Lester S. Ries
Vol. 14, *No.* 1. *January*, 1942. *p.* 39

Roof of natatorium at Oberlin College supported by timber trusses; heating of pool area accomplished by means of recessed radiators and blower heaters; attic used as plenum chamber; roof timbers rotted; repairs made; ducts changed so that one unit heater serves attic space and other unit serves pool space only; attic space scoured by unit heater supply; humidistat in attic governs operation of unit; prevents high humidities which cause deterioration of building construction.

Boiler Firebox Maintenance, by Kalman Steiner
Vol. 14, *No.* 10. *October*, 1942. *p.* 610

Importance of proper maintenance of boiler refractories in wartime; description of fireclays; firebrick types; plastic firebrick; bonding cements; insulating brick; insulating concrete; illustration of spreader type stoker setting reconstructed with plastic firebrick.

Boiler and Radiator Industry Surveys Plants to Speed Conversion
Vol. 14, *No.* 8. *August*, 1942. *p.* 477

(War Problems Forum); survey of manufacturing facilities of members of Institute of Boiler and Radiator Manufacturers completed; detailed information on number of employees, floor area, number of cupolas, capacity of cranes, types of molding, average and maximum weight of castings, type of cleaning used for castings, and other facilities, such as tool rooms and pattern shops; annual volume of business; standing of companies.

Booster Triples Capacity of 36 Year Old Boiler
Vol. 14, *No.* 7. *July*, 1942. *p.* 429

Forced recirculation booster unit increases capacity of boiler at B. Altman & Co. department store, New York, from 250 to 850 hp; how the booster unit functions; high nickel chromium alloy tubes.

Bureau of Mines Studying Stockpiling of Coal
Vol. 14, *No.* 11. *November*, 1942. *p.* 668

(War Problems Forum); survey of action of coal in storage under various conditions being made; questionnaires sent to commercial users; percentage reduction in heating value of coals due to storage.

Buying and Checking Fuel, by R. E. Hieronymus
Vol. 14, *No.* 1. *January*, 1942. *p.* 11

New procedure used by building management firm provides for guaranteed heat content of coal and definite penalties for poor performance; principal criterion in choosing a fuel is the Btu's available for one cent; chart of comparative fuel values for Chicago during 1941; conversion of equipment when fuel costs change; optimistic Btu values used by coal dealers; bidding on fuels complicated in recent years; contract form for coal purchasing.

Buying and Checking Fuel, by R. E. Hieronymus
Vol. 14, *No.* 2. *February*, 1942. *p.* 96

Brief description of method of making coal analyses in commercial testing laboratories; proximate analysis and ultimate analysis; as received basis; dry basis; moisture in coal and effect on efficient burning; sample analysis; what analysis means; advantages of buying coal on guaranteed basis; frequency of testing coal delivered.

Chart for Estimating Fuel Oil Wasted
Vol. 14, *No.* 12. *December*, 1942. *p.* 729

(HPAC data sheet); chart of stack flue gas temperature and per cent carbon dioxide in flue gas showing gallons of fuel oil wasted per 1,000 gal used for various efficiencies.

Check List for Wartime Heating Economy, by Eph. A. Tyler
Vol. 14, *No.* 11. *November*, 1942. *p.* 657

Principles of heating economy; checking distribution system; building leaks; ventilation; heating and fuel records.

Coal Storage
Vol. 14, *No.* 6. *June*, 1942. *p.* 354

Brief recommendations for amount of coal storage which industrial plants, utilities and householders should try to maintain, according to Howard A. Gray, acting director of solid fuel coordination.

Commercial, Industrial Stoker Sales Up
Vol. 14, *No.* 9. *September*, 1942. *p.* 547

Factory sales of commercial and industrial stokers increase during first half of 1942 over same period of 1941; residence sizes decline; permits for installation of fuel burning equipment issued by Chicago smoke department for first seven months of 1942 compared with same period in 1941.

Commercial, Institutional, and Industrial Buildings Must Convert to Coal If Facilities Available, Says OPA
Vol. 14, *No.* 10. *October,* 1942. *p.* 620

Fuel oil for heating apartment houses and commercial, industrial, and institutional establishments to be denied where such buildings possess facilities to convert to coal, according to Paul M. O'Leary, deputy OPA administrator; how rationing is to be applied to buildings other than private homes; four zones for fuel oil rationing.

Deputy Chief of WPB Heating Branch Appointed
Vol. 14, *No.* 9. *September,* 1942. *p.* 556

Ronald Allwork appointed deputy chief of WPB plumbing and heating branch; duties of planning and projects section consolidated under direction of Arthur L. Rayhawk.

Design of an Oil Fired High Pressure Steam Plant, by Kalman Steiner
Vol. 14, *No.* 1. *January,* 1942. *p.* 32

Determining steam load; allowing for piping loss and peak load; selecting boiler capacity; boiler ratings; method of expressing load on boilers; water tube and fire tube boilers; heat release rates; draft requirements.

Design of an Oil Fired High Pressure Steam Plant, by Kalman Steiner
Vol. 14, *No.* 2. *February,* 1942. *p.* 114

Four distinct types of burners; selection of burners, pumps and heaters; number of burners; pipe sizes; table of nominal pipe sizes for oil and steam for various gal per hr firing rates; automatic ignition; draft control; oil storage; principles discussed have speeded defense projects.

District Heating Association Considers Wartime Problems, by Glen D. Winans
Vol. 14, *No.* 7. *July,* 1942. *p.* 403

National District Heating Association holds two-day streamlined annual meeting; priorities; purchasing problems; blackout provisions and protection of heating plants and systems; methods of saving heat; oil shortage; rate increases; equipment, design and construction changes brought about by material scarcities; steel heating surface; corrosion; water heaters; boiler water treating chemicals; weather bureau data; building volume measurements; operating statistics for 1941; new officers.

Don't Trust Your Memory on Maintenance Work, by L. O. Adams
Vol. 14, *No.* 10. *October,* 1942. *p.* 592

Care of mechanical equipment so vital in wartime that regular system for routine maintenance is necessary; unit ventilators; unit heaters; roof spray systems; steam traps; boilers; boiler water; boiler settings; importance of boiler room instruments; stokers; temperature control; fire hazards.

Dormitories for War Workers to Have Forced Warm Air Heating
Vol. 14, *No.* 7. *July,* 1942. *p.* 422

Federal Public Housing Authority developing duration dormitories of temporary nature to provide essentials of housing; each dormitory composed of sleeping wings with a sanitary center; forced warm air furnace, largely masonry with metal grates, and nonmetallic ducts to be used; preliminary sketches of dormitory.

Economical Operation of Heating Systems
Vol. 14, *No.* 12. *December,* 1942. *p.* 720

(War Problems Forum); suggestions for economical operation of heating systems in post offices issued by Post Office Department; importance of carrying proper temperatures; unnecessary ventilation; eliminating leaks; shutting off steam; checking controls; banking fires; forced draft on stoker fired jobs; use of stack damper with hand fired plants; adjustment of gas burners.

Electric Heat Applications, by Lee P. Hynes
Vol. 14, *No.* 1. *January,* 1942. *p.* 40

Comment on article by Siegfried Ruppright published in November, 1941, HPAC; best application of electric heat depends upon circumstances; wattages per foot of pipe depend upon requirements of materials handled.

Engineering Problems in Air Cargo Transportation
Vol. 14, *No.* 5. *May,* 1942. *p.* 297

Excerpts from paper by R. D. Kelly and W. W. Davies on heating and ventilating cargo planes; need for temperature control, ventilation and supercharging.

Every Coal Consumer Can Aid Victory by All-Out Conservation
Vol. 14, *No.* 7. *July,* 1942. *p.* 407

(War Problems Forum); excerpts from talk by Thomas J. Thomas at annual convention of Smoke Prevention Association; importance of conserving coal.

Exhaust Office Air Heats Steel Storage Warehouse
Vol. 14, *No.* 9. *September,* 1942. *p.* 553

Sheet stocks at Joseph T. Ryerson & Son, Inc., protected from condensation damage by duct system using heated air exhausted from offices; why condensation occurs; importance of preventing damage; steam supplied by three water tube boilers fired with pulverized coal; replacing pipe coil radiation with unit heaters; importance of salvaging old pipe coils.

Find Fuel Variations Affect Boiler Tests
Vol. 14, *No.* 11. *November,* 1942. *p.* 656

Engineering representatives of members of Institute of Boiler and Radiator Manufacturers meet; tests conducted on boilers of approximately 40 in. grate width to determine if IBR code provisions should be revised; code requirements for analyzing fuel used in tests tightened up.

Floor Coils Heat Auditorium of New Community Church
Vol. 14, *No.* 4. *April,* 1942. *p.* 223

Description of Community church in Kansas City designed by Frank Lloyd Wright; wall construction; floor heating for auditorium; wrought iron piping embedded in floor construction; ventilation of auditorium; floor coils to be used for precooling in summer; a number of questions will be answered by experience with precooling system; three zone air conditioning units; design temperatures and humidities; 30 hp condensing unit; oil burning boiler; circulation of air in spaces between steel beams; control methods; on dedication day hot water pump was running backward due to switched electrical phases; improper location of thermostat for floor coil system corrected.

Fuel Conservation a Wartime "Must"
Vol. 14, *No.* 10. *October,* 1942. *p.* 608

("Open for Discussion"); letters from Joel Dean of Office of Price Administration, and P. A. Hyde of Ohio Edison Co., commenting on article by Eph. A. Tyler on fuel conservation published in September issue.

Fuel Conservation—Always Good Business—Becomes Wartime "Must," by Eph. A. Tyler
Vol. 14, *No.* 9. *September,* 1942. *p.* 532

Importance of fuel conservation in wartime; suppose government should restrict maximum fuel allowance to equivalent of 0.6 lb of steam per 1,000 cu ft of building volume per degree day; importance of temperature control; stopping leaks of heated air from building; tight outside air intakes; importance of free circulation in piping; removing sludge from piping; how to keep track of fuel consumption; how good is your fuel consumption record? (See comments on p. 608, October issue).

Giant Flying Boats May Solve United Nations Shipping Problems
Vol. 14, *No.* 9. *September,* 1942. *p.* 548

Brief description of Glenn L. Martin Co.'s Mars, world's largest flying boat; flight deck and portion of main deck supercharged; heating and supercharging promote efficiency of crew; brief description of Mars.

Graphical Analysis of Periodic Loads, by B. F. Raber and F. W. Hutchinson
Vol. 14, *No.* 4. *April,* 1942. *p.* 241

(HPAC data sheet); method of solving graphically the effect on heating and cooling requirements imposed on a structure by periodic changes in outside temperature; advantages of method; step by step procedure for applying it. (Discussion on p. 298, May issue).

Graphical Analysis of Periodic Loads
Vol. 14, *No.* 5. *May,* 1942. *p.* 298

("Open for Discussion"); comments of Elmer G. Smith and Victor Paschkis on data sheet on graphical analysis of periodic loads, by B. F. Raber and F. W. Hutchinson, which was published in April, HPAC; advantage of Schmidt method; desirability of reducing data to tabular form; advantages of electrical analogy method in analyzing problems. (Also see p. 354, June issue).

Heating and Air Conditioning Industries Help in Scrap Drive
Vol. 14, *No.* 10. *October,* 1942. *p.* 595

(War Problems Forum); Cloud Wampler, president of Carrier Corp., and Herbert V. Kohler, president of Kohler Co., participating in work of American Industries Salvage Committee, letter to heating and air conditioning companies urging full cooperation with industrial salvage program; how to cooperate in program.

Heating Limitation Order L-79 Explained by Questions and Answers
Vol. 14, *No.* 8. *August,* 1942. *p.* 478

(War Problems Forum); plumbing and heating branch of War Production Board issues questions and answers explaining general limitation order L-79 on heating and plumbing equipment as amended May 23, 1942.

Heating Limitation Orders Come Thick and Fast
Vol. 14, *No.* 5. *May,* 1942. *p.* 289

(War Problems Forum); numerous limitation orders on heating equipment issued; effect of orders; effect of freezing order of March 25 on steam and hot water unit heater sales.

Heating Section Requirements of New Defense Housing Critical List
Vol. 14, *No.* 4. *April,* 1942. *p.* 233

(War Problems Forum); new defense housing critical list issued by housing priorities branch of War Production Board; preference ratings for defense housing projects may be applied only to items appearing on list; heating section of list; general requirements; maximum net hourly output capacity of heating unit or system; total hourly heat loss of building; determining output capacity of floor furnaces; space heaters, gravity furnaces, forced warm air furnaces and boilers; permissible installations; warm air distribution systems; steam or hot water systems; firing equipment; control equipment; other equipment.

High Velocity Air Circulation Solves Problem of Heating Large Gym or Armory
Vol. 14, *No.* 1. *January*, 1942. *p.* 30

Method of heating Patten gymnasium, Northwestern University, Evanston, Ill.; no direct radiation; air is "squirted" through nozzles at 2,000 fpm velocity; method developed originally for automatic telephone exchanges and industrial use; method of heating and ventilating swimming pool; steam furnished by central plant; schematic diagram of system. (Discussion on p. 228, April issue).

Hollow Floors for Radiant Heating, by F. E. Markus
Vol. 14, *No.* 3. *March*, 1942. *p.* 176

New low cost, hollow, fireproof floor system developed in connection with research on hospital construction; applications to industrial and other building types feasible; particularly suitable for radiant heating installations using warm air, as method incorporates integral duct system.

How Can I Figure the Heat Transfer Coefficients for These Walls?, by Paul D. Close
Vol. 14, *No.* 7. *July*, 1942. *p.* 427

Answer to reader's question on how to figure heat transfer coefficients for two wall constructions involving cork, tile, or concrete and wide air spaces.

How Can We Burn Both Coal and Oil?
Vol. 14, *No.* 9. *September*, 1942. *p.* 542

(War Problems Forum); HPAC reader asks for suggestions on burning both coal and oil intermittently or at same time in boiler; Kalman Steiner gives recommendations and sketches; round boilers; rectangular cast iron and return tubular steel firebox boilers; portable steel firebox boilers; construction of dutch oven; combustion safety control and draft requirement; setting of oil fired boiler at New England deposit library briefly described by G. K. Saurwein.

How Does the Switch to Steel Affect Heating Surface Performance?
Vol. 14, *No.* 3. *March*, 1942. *p.* 166

(War Problems Forum); copper and aluminum no longer used for blast heating coils except under special circumstances; heat conductivity of coils of steel compared with copper; conductivity of fin material; thickening of fins results in smaller free area which increases air friction loss; corrosion must be carefully considered, particularly with steam coils; preventive measures comprise proper drainage and trapping, protective coating of steel, and water treatment; importance of periodic checks on condensate when water is treated. (Discussion on p. 228, April issue).

How to Save Fuel to Aid War Effort
Vol. 14, *No.* 10. *October*, 1942. *p.* 616

Twelve ways in which industrial plants can save fuel outlined by John E. Haines.

I'm Having Trouble with a Transfer Heater, by Samuel R. Lewis
Vol. 14, *No.* 8. *August*, 1942. *p.* 479

(Answer to a reader's question); contractor having trouble with office heating system involving transfer heater for heating hot water by means of steam boiler; analysis of installation; design suggestions for transfer devices of this type; temperature differences; water flow; heat transfer rates; suggestions for correcting the trouble; sketches showing plant as installed and recommended changes.

L-107 Replaces March 24 Freeze Order
Vol. 14, *No.* 7. *July*, 1942. *p.* 414

WPB limitation order L-107 replaces telegraphic freeze order issued March 24; order covers extended surface heating equipment, including unit heaters, unit ventilators, blast heating coils, convectors, and winter air conditioners.

Limitation Order Curtails Use of Fuel Oil
Vol. 14, *No.* 4. *April*, 1942. *p.* 230

(War Problems Forum); limitation order L-56 of War Production Board discourages installation of new fuel oil burning equipment in several states and District of Columbia; provisions of order.

Low Pressure Heating Boilers Simplified
Vol. 14, *No.* 4. *April*, 1942. *p.* 232

(War Problems Forum); limitation order L-42 of War Production Board eliminates metal jackets, fusible plugs, and tri-cocks on low pressure heating boilers; savings to be made.

Message to All Coal Consumers, A—From Donald M. Nelson
Vol. 14, *No.* 6. *June*, 1942. *p.* 37 (*front section*)

Donald M. Nelson, chairman of War Production Board, urges all coal consumers, especially large industrial users and war plants, to begin stockpiling coal at once.

Modernized Heating System for Enlarged Factory Keeps the Operating Cost Down
Vol. 14, *No.* 2. *February*, 1942. *p.* 100

Old heating system converted to one pipe, forced circulation, hot water installation when plant for manufacturing precision equipment was enlarged; seven zones; unit heaters, cast iron radiators, copper convectors and blast heating coils; floor space increased 86 per cent, but heating cost increased only 16 per cent.

Navy Recreation Building Heated and Cooled, by O. E. Gammill, Jr.
Vol. 14, *No.* 8. *August*, 1942. *p.* 475

(War Problems Forum); unusual problems in heating and air conditioning of recreation building at southern naval base; short operating period, varying internal heat load, and high humidities and temperatures; combination cooling, heating and ventilating system; direct expansion coils; gas unit heaters; 50 ton cooling capacity.

New England Deposit Library Provides Storage for "Dead" Books, by G. K. Saurwein
Vol. 14, *No.* 8. *August*, 1942. *p.* 486

Description of new library for storing seldom used books; building construction; welded steel boiler fired by oil; grates allow coal firing; vacuum steam system; ducts; considerable cooling can be accomplished by running fans at night.

Oil Supply, by H. B. Siemon
Vol. 14, *No.* 3. *March*, 1942. *p.* 161

("Open for Discussion"); brief comment on natural gas and fuel oil situation in Kansas City territory.

OPA Rules on Burner Service Rates
Vol. 14, *No.* 12. *December*, 1942. *p.* 721

Three conditions which an oil burner service company must meet before it may increase its rates over those of last winter laid down by OPA.

Panel Heating, Fluorescent Lighting Feature New Addition to High School, by Erwin L. Weber
Vol. 14, *No.* 3. *March*, 1942. *p.* 159

Panel heating and indirect fluorescent lighting combined in addition to Clover Park high school, Tacoma, Wash.; no basement; water for panel coils heated in converter; five separate heating zones; details of panel coils in suspended ceiling; system comprises 13,000 lineal feet of steel pipe coils; joints welded; 70 per cent of coils in concrete ceiling slabs and balance embedded in suspended ceilings; radiant heat follows same reflection laws as does light.

Panel Heating's Value Proved by Use, by T. Napier Adlam
Vol. 14, *No.* 2. *February*, 1942. *p.* 110

("Open for Discussion"); comment on remarks of J. H. Walker on pp. 751-752 of December, 1941, HPAC; effect of radiant heating on people; possible advantages of cooler air; conflict between laboratory investigations and experience in field; radiant heating used many years in Europe.

Practical Pointers on Temperature Control, by A. B. Newton
Vol. 14, *No.* 12. *December*, 1942. *p.* 714

("Open for Discussion"); comments on article by William Goodman on temperature control published in November issue; use of low limit thermostats; air distribution; multiple thermostats; fan control in warm air heating system; two speed motors; use of check dampers to prevent back flow while fan is operating and permit gravity circulation while fan is not operating.

Protecting Steel Heating and Cooling Coils, by C. M. Sterne
Vol. 14, *No.* 4. *April*, 1942. *p.* 228

("Open for Discussion"); comments on article published in War Problems Forum of March, HPAC; rapid corrosion attack in summer; steel heating coils should have zinc coatings; methods of applying zinc coatings; corrosion of cooling coils by condensate from air; painting with phenolic resins; importance of water treatment; making pH studies.

Pulverized Coal by Steam Explosion
Vol. 14, *No.* 8. *August*, 1942. *p.* 472

Pulverized coal for burning under boilers produced by sudden expansion of steam within the pores; research at Armour Research Foundation; method of pulverizing.

Restricts New Uses of Manufactured Gas
Vol. 14, *No.* 10. *October*, 1942. *p.* 612

Delivery of manufactured gas to new industrial and domestic consumers restricted by War Production Board order L-174; principal requirements of order; essential civilian services.

Rules for Safe Storage of Coal
Vol. 14, *No.* 3. *March* 1942. *p.* 167

(War Problems Forum); domestic and industrial consumers urged to build stockpiles of coal; rules of U. S. Bureau of Mines for safe storage of bituminous coal; regular check on temperature of coal pile; sealing coal pile; spontaneous heating.

Selected Listing of Articles on Fuel Conservation Published in Heating, Piping & Air Conditioning
Vol. 14, *No.* 9. *September*, 1942. *p.* 552

Listing of articles published in HPAC pertaining to fuel conservation and better heating presented for convenience of readers who wish to refer to back issues.

Six Point Program for Saving Fuel
Vol. 14, *No.* 10. *October,* 1942. *p.* 596

(War Problems Forum); six recommendations for wartime fuel conservation given by J. W. Pauling.

Some Practical Pointers on Temperature Control, by William Goodman
Vol. 14, *No.* 11. *November,* 1942. *p.* 661

Practical considerations involved in application of control instruments which frequently make the difference between a highly successful or an unsatisfactory installation; use of low limit thermostats in hot blast heating systems; importance of proper air introduction to rooms; multiple thermostats; difficulty in maintaining designed differential; correct and incorrect installation of three way mixing valves; preventing freeze-ups of heating coils; use of two coils; difficulties; difficulties eliminated by using single coil controlled by face and bypass dampers; suggested construction for face dampers; starting and stopping fans; two speed fan motors; outdoor air dampers.

Stoker Permits Gain
Vol. 14, *No.* 11. *November,* 1942. *p.* 658

Permits for fuel burning installations in Chicago for first nine months of 1942 compared with first nine months of 1941.

Summary of Principal WPB Orders Affecting Heating and Plumbing
Vol. 14, *No.* 6. *June,* 1942. *p.* 38 *(front section)*

Listing of various War Production Board orders, showing subject of order and order number, which affect heating and plumbing.

Unit for Heat Transfer Rates
Vol. 14, *No.* 8. *August,* 1942. *p.* 470

The watt, with its multiples and submultiples, suggested as logical and convenient unit for stating energy flow rates, by Prof. Lionel S. Marks; values of various conversion factors; watt adopted by power test code committee of ASME as preferred unit in stating heat transfer rates.

Viscosity Compensation for Oil Burners, by Kalman Steiner
Vol. 14, *No.* 5. *May,* 1942. *p.* 292

What is meant by "viscosity compensation"; principle of operation of viscosity compensator; various types of compensators described and illustrated; flow scheme for plant with several burners using Bunker C fuel oil; practical suggestions on layout of systems. (Also see p. 38, front section, June issue).

WPB Allocates Materials to Convert to Coal
Vol. 14, *No.* 9. *September,* 1942. *p.* 543

(War Problems Forum); War Production Board allocates iron and steel necessary to manufacture grates for conversion of oil burning installations to coal; how to order grates; how manufacturer may obtain iron and steel for grates.

WPB Announces New War Housing Construction Rules
Vol. 14, *No.* 12. *December,* 1942. *p.* 720

(War Problems Forum); war housing construction standards issued by WPB; large and small projects affected; permissible installations of heating units are specified for various types of buildings.

WPB Issues Order Assigning A-10 Rating for Heating Repairs
Vol. 14, *No.* 4. *April,* 1942. *p.* 229

(War Problems Forum); order P-84 of War Production Board facilitates maintenance and repair of heating and plumbing installations in office, apartment, farm and residence buildings; importance of maintaining existing facilities; definition of heating equipment; definition of emergency repairs; provisions of the order.

WPB Permits Assembly of Small Stokers
Vol. 14, *No.* 7. *July,* 1942. *p.* 402

War Production Board speeds conversion of oil burning equipment to coal by permitting assembly of small stokers from materials in manufacturers hands on May 31; permission contained in amendment 1 to limitation order L-75; stokers released from freeze provisions of order L-79; new operations section of plumbing and heating branch of WPB.

Water Treatment Conserves Heating and Piping Equipment, by J. Neil Smith, Jr.
Vol. 14, *No.* 6. *June,* 1942. *p.* 352

(War Problems Forum); importance of maintenance of mechanical equipment and prevention of corrosion; scale formation in boilers; boiler water treatment; examples of damage caused by corrosion; conditioning steam lines to prevent corrosion; experience of large central heating plant.

What's Wrong with This Heating System?, by Samuel R. Lewis
Vol. 14, *No.* 4. *April,* 1942. *p.* 240

Reader asks help in locating trouble with one pipe steam heating system which is giving difficulty; analysis of piping layout and suggested change.

Why a Close Nipple in the Hartford Loop?, by Samuel R. Lewis
Vol. 14, *No.* 5. *May,* 1942. *p.* 301

Answer to a reader who asks why reference books advise use of close nipple in return main where a Hartford loop joins the tee on the balance pipe. (See discussion on p. 549, September, 1942, HPAC).

Why a Close Nipple in the Hartford Loop?
Vol. 14, *No.* 9. *September,* 1942. *p.* 549

("Open for Discussion"); comments of R. D. McNeice on Samuel R. Lewis' reply to a reader (published in the May, 1942, HPAC) about why a close nipple is used in the Hartford loop; reason for using is to prevent water hammer; sketches showing four methods of piping Hartford equalizer; additional comments by Mr. Lewis on use of 45 deg Y bend.

Wide Variety of Standard Heating and Air Conditioning Equipment in War Use, by Fred Pederson
Vol. 14, *No.* 3. *March,* 1942. *p.* 153

Army posts and naval stations reveal an astonishing variety of interesting applications of standard heating, cooling and air conditioning equipment; many uses of standard unit air conditioners; heating coils; unit heaters; description of heating and air conditioning at naval air station; officers' quarters; transforming airplane hangars into living quarters for sailors; other buildings at training station; sloping top convectors in general hospital at army fort.

Piping

ASA Approves Twenty-Three ASTM Standards
Vol. 14, *No.* 10. *October,* 1942. *p.* 606

American Standards Association announces approval of 23 standards and specifications developed by American Society for Testing Materials; list of standards of interest to HPAC readers.

Advantages of Welded Piping for Speeding Shipbuilding, by W. H. Girdler, Jr.
Vol. 14, *No.* 11. *November,* 1942. *p.* 666

Importance of efficient and speedy shipbuilding; prefabricating and preassembling piping systems; saving space and weight by welding; sketch showing use of welded fittings in auxiliary exhaust piping system; welding obviates special castings and drilling.

Ancient Piping System Advantage to London
Vol. 14, *No.* 1. *January,* 1942. *p.* 29

Brief report of talk given before ASME by Walter D. Binger, commissioner of borough works, New York, N. Y.; network of piping in London made possible quick repairs of bomb damage, factory spaces 80 ft underground built in abandoned quarries.

Change in Piping Corrects Trouble with Boiler Water Level, by R. S. Hawley
Vol. 14, *No.* 4. *April,* 1942. *p.* 236

Difficulty experienced in keeping water line in sight on gage glass with two low pressure horizontal tubular boilers; check of piping connections located difficulty; change in piping solves problem.

Chromium and Nickel for Industrial Process Regulators
Vol. 14, *No.* 7. *July,* 1942. *p.* 406

(War Problems Forum); part 1244 of conservation order L-134 issued by WPB restricts use of chromium and nickel in instruments, control valves, and regulators.

Code for Pressure Piping, by Sabin Crocker
Vol. 14, *No.* 1. *January,* 1942. *p.* 1

Many advances in piping incorporated in the ASA code for pressure piping B31 issued as tentative American standard in 1935 and being re-issued as full American standard; purpose of the code; sections on power piping, gas and air piping, oil piping, district heating piping, refrigeration piping, fabrication details and materials; pipe wall thickness; formulas for pipe wall thickness; variation in wall thickness for seamless pipe; non-ferrous pipe and tubing; allowable stress; advances in welding; welding fittings; bolting. (Also see p. 495, August, 1942, HPAC).

Code for Pressure Piping, by Alfred Iddles
Vol. 14, *No.* 2. *February,* 1942. *p.* 101

Discussion of requirements of section 1 on power piping systems of new ASA code for pressure piping (B31); scope of section 1; agreement with ASME boiler construction code; special cast steel fittings; welded branch connections; welded joints; marking welded joints; pre-heating; stress relieving; pipe; design pressures and temperatures; expansion and flexibility; pressure-temperature swings in power plant operation; boilerfeed systems; bolting. (Also see p. 495 August, 1942, HPAC).

Code for Pressure Piping
Vol. 14, *No.* 3. *March,* 1942. *p.* 155

Section 2 of ASA code for pressure piping (B31), on gas and air piping, reviewed by John S. Haug; piping systems grouped into two divisions; pipe wall thickness and working pressure; fittings; pressure testing; bolting; pipe joints; section 3 on oil piping, refinery gas piping and piping for gasoline recovery plants reviewed by A. D. Sanderson; cast iron pipe and fittings; pipe joints, flange facings; pipe wall thickness; materials; creep.

Code for Pressure Piping, by G. K. Saurwein and A. B. Stickney
Vol. 14, *No.* 4. *April,* 1942. *p.* 215

Discussion of section on district heating piping systems of new ASA code for pressure piping B31, by G. K. Saurwein; scope of district heating piping section; valves; plug and angle valves;

reducing and relief valves; drains, drips and steam traps; hydrostatic tests; general requirements; refrigeration piping system section discussed by A. B. Stickney; materials for low temperature service; allowances for brittleness of various materials; design pressures; pipe; pipe joints; stop valves; tests; specific requirements.

Code for Pressure Piping, by Ludwig Skog
Vol. 14, *No.* 5. *May,* 1942. *p.* 302
Discussion of section 6 on fabrication details of new ASA code for pressure piping; scope of section; hangers, supports, etc.; pipe joints other than welded; welding flanges; flange facings; expansion and flexibility; welded hanger clips for power piping.

Code for Pressure Piping, by Ludwig Skog
Vol. 14, *No.* 6. *June,* 1942. *p.* 357
Completion of discussion of section 6 of new code, on fabrication details; backing rings; welding grooves; fillet welds; preheating; stress relieving; operator and procedure qualification; number and type of qualification tests required; welded branch connections and fabricated or cast specials; development of rules; types of reinforcement and preparation; drawings showing various types of welded joints, minimum requirements for socket and fillet weld dimensions, welding flanges, strap and saddle reinforcements, etc.

Code for Pressure Piping
Vol. 14, *No.* 7. *July,* 1942. *p.* 410.
F. H. Morehead discusses section 7 on materials, their specifications, and identification, in new American Standard Association code for pressure piping; E. B. Ricketts describes how sectional committee functions in formulating a piping code; some of the problems; wording the code; efficiencies for seamless and welded pipe; subcommittee 1 authorized to interpret code requirements.

Code for Pressure Piping, by Sabin Crocker
Vol. 14, *No.* 8. *August,* 1942. *p.* 495
Attention called to a few editorial changes in new ASA code for Pressure Piping which affect articles published in January and February, 1942, HPAC; use of actual measured wall thickness and actual measured outside diameter of pipe on hand or in stock when computing service pressure; welding fittings; bar stock nuts; washers; temperature to be used in design of oil piping for power plant service.

Compressed Air Speeds Bomber Part Testing Job
Vol. 14, *No.* 8. *August,* 1942. *p.* 495
Comparator operating in connection with hardness gage speeds testing of bomber parts; operated by compressed air under 100 psi; method of using.

Corrosion of Alloy Steel by High Temperature Steam
Vol. 14, *No.* 9. *September,* 1942. *p.* 540
Paper on corrosion of stressed alloy steel bars by high pressure steam presented at semi-annual meeting of American Society of Mechanical Engineers; data show effect of stress on corrosion of various alloy steels.

Corrosion Tests of Soldered Joints on Copper Tubes, by A. W. Tracy
Vol. 14, *No.* 9. *September,* 1942. *p.* 538
Value of breaking load in pounds for type L hard copper tube soldered joint assemblies reported; tests made over periods of one, three, and six years; wrought copper and cast brass couplings and five different solders tested; results of tests; conclusions.

Cutting Pipe on the Run
Vol. 14, *No.* 3. *March,* 1942. *p.* 168
Illustration and brief description of "hot saw" for cutting red hot pipe as it comes out of mill; electric controls synchronize motion of saw and pipe.

Damage to Piping Through Enemy Action
Vol. 14, *No.* 11. *November,* 1942. *p.* 137 *(back section)*
Excerpts from paper by Hal Gutteridge on the proneness to damage of industrial plants through enemy action; the damage proneness number; recommendations for piping design and installation to minimize damage.

Flow Meters Reveal Waste of Steam, by S. D. Distelhorst
Vol. 14, *No.* 4. *April,* 1942. *p.* 219
Flow meter chart reveals waste of steam in plant due to neglect in closing valve on line to hot water heater at night; amount of loss.

Flow of Solids in Piping, by H. E. Babbitt and D. H. Caldwell
Vol. 14, *No.* 7. *July,* 1942. *p.* 423
Practical data on pumping and piping sludges, muds, and suspensions; viscous flow and plastic flow; critical velocity; turbulent flow; experimental verification of plastic flow equation; friction factor chart; comparison of observed and computed values of head loss in pipes, and of critical velocities; viscosity of water at various temperatures; bibliography. (See correction on p. 478, August issue).

Flow of Solids in Piping
Vol. 14, *No.* 8. *August,* 1942. *p.* 478
Correction in equation 6 of article Flow of Fluids in Piping, which was published in July, 1942, HPAC.

Flow of Solids in Piping, by H. E. Babbitt and D. H. Caldwell
Vol. 14, *No.* 8. *August,* 1942. *p.* 491
Method of measuring values of yield value and coefficient of rigidity; viscometers; modified viscometer; tabulated constants for plastic flow of sludge; practical applications of equations presented; variation of yield value with concentration of suspended matter for Tennessee ball clay.

Help Put Empty Cylinders to Work
Vol. 14, *No.* 8. *August,* 1942. *p.* 477
(War Problems Forum); increased demand for oxygen and acetylene; cylinders must be kept moving; oxygen and acetylene should be ordered for immediate needs only.

How Piping Is Welded for Navy Service
Vol. 14, *No.* 4. *April,* 1942. *p.* 235
Welding applications in naval machinery described before annual meeting of American Welding Society by Hugo W. Hiemke and John D. Bert; advantages of welding; welding high pressure, high temperature steam lines; qualification of operators; use of backing ring; radiography; magnaflux inspection; hard surfacing discs and seats of valves; welding low pressure steam piping; silver brazing non-ferrous piping; careful procedure control required; typical welded joints; inserted ring type fittings used for silver brazing.

How to Protect Equipment Against Failure of Flow, by William Goodman
Vol. 14, *No.* 6. *June,* 1942. *p.* 347
New data alloy easy selection of orifices for use with differential pressure switches to guard against damage from flow failure in air conditioning, chilled water and other piping systems; methods of stopping compressor in case flow ceases; advantages of using orifice and differential pressure switch; maximum drop through orifice; selecting orifice; pressure loss through orifice; tables for maximum pressure drop across orifice for maximum flow, values of orifice constant, and pressure loss across orifice in per cent of pressure drop.

How to Protect Equipment Against Failure of Flow, by William Goodman
Vol. 14, *No.* 7. *July,* 1942. *p.* 417
Construction of an orifice satisfactory for operation with a differential pressure switch; orifice ,dimensions; orifice installation; minimum straight length of pipe required on downstream side of orifice; pressure tappings and their location; switch connections; use of manometers; how to apply data to liquids other than water; determining Reynolds number.

How You Can Help Conserve Essential Metals, by Alfred J. Eichler
Vol. 14, *No.* 4. *April,* 1942. *p.* 230
(War Problems Forum); how users of valves and fittings can assist in conserving essential metals.

Improvised Aftercoolers for Compressed Air, by G.K.S.
Vol. 14, *No.* 12. *December,* 1942. *p.* 721
(War Problems Forum); increase in compressed air facilities required at war plant; air compressors added; aftercoolers not easily available; two used return tubular boilers employed as aftercoolers.

Insulation of Cold Pipe Lines
Vol. 14, *No.* 7. *July,* 1942. *p.* 415
(HPAC data sheet); Industrial Mineral Wool Institute adopts specifications for use of mineral wool in low temperature installations; application of mineral wool felt on cold pipe lines; recommended thickness; preparation of surface; fittings; finish on straight piping, valves, and fittings; painting.

Limitation Order on Industrial Controls
Vol. 14, *No.* 10. *October,* 1942. *p.* 622
WPB order L-134 restricting use of chromium, nickel, and their alloys to specified operating conditions of instruments, valves, and regulators revised.

New Information About Flow of Fluids in the Critical Region
Vol. 14, *No.* 9. *September,* 1942. *p.* 541
Uncertainty as to exact location of critical region in terms of Reynolds numbers; experiments by A. H. Nissan indicate that critical region shows three distinct and different phases; precritical, true critical, and post critical regions.

New Oil Distribution System Cuts Consumption, Helps Maintenance
Vol. 14, *No.* 11. *November,* 1942. *p.* 653
Eight different petroleum products pumped in separate piping systems to individual machines and points of use in plant producing bars, wire, precision shafting, and special shapes of cold finished steel; advantages of method; storage tanks; gear pumps; identification of piping systems; soluble oil; oil filtering units; settling tanks; settling basins; drawing oil; relief valves.

Pipe Fittings for Sprinkler Systems
Vol. 14, *No.* 9. *September,* 1942. *p.* 554
Permission to manufacture pipe fittings for fire protection sprinkler systems granted by WPB.

Piping—Industry's Most Important Transportation System—Plays Vital Role in All-Out War Effort
Vol. 14, *No.* 5. *May,* 1942. *p.* 290

Importance of piping systems in industrial plants to production for victory; isometric drawing of piping services in paper mill; equipment and piping services identified by key numbers.

Plastic Tubing—A "War Baby," by C. B. Branch and D. L. Gibb
Vol. 14, *No.* 6. *June,* 1942. *p.* 353

Characteristics of one of the plastic tubings; bursting pressures; effect of temperature; service characteristics indicate advantages and limitations; fittings; bending the tubing; steps in flaring illustrated.

Practical Piping Problems, by W. H. Wilson
Vol. 14, *No.* 2. *February,* 1942. *p.* 118

Experiences with an industrial plant pipe line installed over 30 years ago; 30 in. pipe of spiral riveted steel, galvanized; flanged joints; piping connections for steam traps for high pressure main discharging into low pressure main; inside of piping inspected; turning on low pressure steam in long main; pipe line broke at welded joint when steam was turned on slowly; large size drain valves and turning on steam quickly have avoided further difficulty.

Practical Piping Problems, by W. H. Wilson
Vol. 14, *No.* 8. *August,* 1942. *p.* 496

Importance of safety and economy in piping practice; baby killed by escaping steam from unplugged radiator connection; installation of drips, drains, blowoffs, and test valves in industrial plants; float control valve on feedwater heater; waste caused by leakage; waste of oil in steel storage department when valves were left open; lockup valve with key should be installed.

Practical Piping Problems, by W. H. Wilson
Vol. 14, *No.* 10. *October,* 1942. *p.* 609

Importance of vigilance in achieving efficient operation; invisible leaks; bypasses around steam traps; bypass valve; improper functioning of tilting steam traps in woodworking shop; how waste was discovered; thermostatic traps; advantage of thermometers in return lines; sectionalizing branch lines.

Prefabricated Piping Speeds Shipbuilding
Vol. 14, *No.* 9. *September,* 1942. *p.* 555

Plan developed by Oregon Shipbuilding Corp. permits prefabrication of piping for installation aboard ship; loft converted into full scale model of machinery space area; color identification of piping and fittings; elevated jigs correspond to openings and fittings on ship's machinery and equipment; prefabricating has broken many bottlenecks in pipe installation; welding time reduced.

Proper Piping System Operation Vital to Efficient War Production, by John J. Harman
Vol. 14, *No.* 5. *May,* 1942. *p.* 281

Importance of proper care, operation and maintenance of pipe lines, valves and fittings; supports; expansion and drainage; proper procedure in opening and closing valves; valve bypasses; danger of opening closed valves too rapidly.

Protecting Tanks and Sprinkling Systems, by M. M. Greer
Vol. 14, *No.* 1. *January,* 1942. *p.* 24

("Open for Discussion"); comment on article published in November, 1941, HPAC, on electric heating of piping and tanks; method of protecting water towers from freezing by using electric immersion heaters; use of immersion heaters for guarding fire protection sprinkling systems from freezing in factories; sketches showing installations.

Radiography Symposium Features ASTM Meeting
Vol. 14, *No.* 8. *August,* 1942. *p.* 483

Highlights of annual meeting of American Society for Testing Materials held June 22-26; symposium on radiography comprises 13 technical papers; radiography of welds; gamma ray radiography of welded high pressure power piping; report of committee on steel; new method of determining elongation values based on pipe wall thickness; new pipe specifications; committee report on malleable iron castings; cast iron; coal and coke.

Return Compressed Gas Cylinders As Quickly As Possible
Vol. 14, *No.* 12. *December,* 1942. *p.* 734

Shortage of cylinders for chlorine, ammonia, carbon dioxide and other gases becoming more drastic; all users and transportation companies must cooperate in returning cylinders to producers, warns R. J. Quinn.

17 Ways to Prevent Welding Fires
Vol. 14, *No.* 3. *March,* 1942. *p.* 164

Material on fire prevention abstracted from pamphlet on safe practices for installation and operation of oxyacetylene welding and cutting equipment; causes of fires; precautions to observe where portable apparatus is involved; maintenance of equipment.

Schedule Number System for Pipe Supplants Old "Standard Weight" and "Extra Strong" Designations, by Sabin Crocker
Vol. 14, *No.* 12. *December,* 1942. *p.* 715

Why the pipe schedule number system has been developed; increase of steam pressures; need for new pipe schedules; schedule numbers explained; basic formula; commercial thicknesses; code formulas; examples showing use of schedule numbers; trade acceptance of schedule numbers; table showing dimensions of American standard welded and seamless steel pipe; standard weights and dimensions of welded and seamless steel pipe as given in ASTM specifications.

Shipyard Pipe Shop Streamlines Fabrication for Liberty Ships, by R. S. Jones
Vol. 14, *No.* 10. *October,* 1942. *p.* 600

Brief description of the Liberty ship; approximately 8½ miles of piping; screwed joints; 31 piping systems; description of pipe shop at Oregon Shipbuilding Corp.; new pipe fabrication methods developed; bending pipe; streamlined pipe fabrication procedure inaugurated; pipe bending machine; cutting pipe; welding flanges; storing pipe.

Sizing Vent Piping for Safety Valves
Vol. 14, *No.* 7. *July,* 1942. *p.* 416

("Open for Discussion"); comment by Max W. Benjamin on article describing Watts Bar steam plant written by H. J. Petersen and published in May, HPAC; possible reasons for difficulty with safety valve vents; vent piping functioned satisfactorily when valves were blown by hand but steam was blown out of umbrella fittings when safety valves popped; separate vent pipes installed; power control valve elevated; expansion joints installed in place of umbrella fittings from escape valves.

Steam Flow Through Safety Valves
Vol. 14, *No.* 9. *September,* 1942. *p.* 540

Bulletin No. 110 of Ohio State University Engineering Experiment Station devoted to steam flow through safety valves; importance of tests.

Steam Requirements of Process Equipment
Vol. 14, *No.* 11. *November,* 1942. *p.* 675

(HPAC data sheet); data on steam requirements of process equipment as given in report of commercial relations committee of National District Heating Association; sources of data; steam requirements of laundry and kitchen equipment, industrial processes and hospital equipment.

Strength of Joints in Copper Tubing
Vol. 14, *No.* 9. *September,* 1942. *p.* 540

Review of National Bureau of Standards report BMS83 on strength of sleeve joints in copper tubing made with various lead base solders.

TVA's Watts Bar Steam Plant Augments Hydro Power for War Production, by H. J. Petersen
Vol. 14, *No.* 5. *May,* 1942. *p.* 283

Design and installation of high pressure steam piping at Watts Bar steam plant; pipe specifications; welded construction; backing rings; main steam piping; stress in bend at throttle valve; safety valve vent piping; motor operated valves; insulation; field welding; preheating; stress relieving. (See discussion on p. 416, July, 1942, HPAC).

13 Ways to Save Oxygen in Welding and Cutting
Vol. 14, *No.* 7. *July,* 1942. *p.* 406

(War Problems Forum); methods of conserving oxygen outlined by G. V. Slottman; recommendations to be followed.

"Trouble Shooter"—for Correcting Pipe Threading Ills, A
Vol. 14, *No.* 12. *December,* 1942. *p.* 722

Chart analyzing pipe threading difficulties and showing what to look for and how to correct such difficulties with both hand threading and machine threading; do's and don'ts in pipe threading.

Use Cast Iron Pipe Flanges to Break Forged Steel "Bottleneck," by G. W. Hauck
Vol. 14, *No.* 10. *October,* 1942. *p.* 615

Why and where to use cast iron flanges in order to overcome wartime steel shortages; why use of steel flanges has increased in recent years; applications of cast iron screwed flanges and cast iron lap joint flanges; sizes; temperatures and pressures; recommendations for use; cautionary suggestions.

War Construction Activities of Heating and Piping Contractors Range from Piping an Ordnance Works to Moving One Radiator
Vol. 14, *No.* 9. *September,* 1942. *p.* 546

Pictures of two large piping jobs of Piping Contractors, Inc.; 37,000 ft of 42 in. pipe enameled inside and coated outside for conveying water required in munitions manufacturing process; extensive piping system for condenser cooling water at power plant; use of asbestos cement pipe; welded steel fittings.

Welding Electrode Conservation
Vol. 14, *No.* 3. *March,* 1942. *p.* 167

(War Problems Forum); important to conserve welding electrode, says Clayton B. Herrick; should be used down to minimum stub end; method employed by one shop to illustrate effect of stub end loss on electrode costs.

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THE EDITOR'S PAGES

THE MAGAZINE you are now holding is the biggest in HEATING, PIPING AND AIR CONDITIONING'S history, and is packed with information in both its editorial and advertising pages which you will want to keep (we feel) within arm's reach for ready reference throughout 1942. The cover is of somewhat heavier stock, you will note, to protect it from wear and tear during the coming months. . . . For the eighth consecutive year, we publish this month a complete directory section of heating, piping and air conditioning equipment for industry and large buildings. First directory to be compiled for this field, and the most thorough and authoritative, it is checked and brought up-to-date every year. This checking involves thousands of manufacturers and more thousands of entries, with the listings arranged by experts. . . . This January, too, (as in other years) there is a special show section with complete information on the annual meeting of the American Society of Heating and Ventilating Engineers, the annual convention of the National Warm Air Heating and Air Conditioning Association, and the International Heating and Ventilating Exposition—all scheduled for the week of January 26 in Philadelphia. . . . An unusually worthwhile selection of articles on heating, piping and air conditioning also features this month's issue, we think. Special attention naturally is given to design, installation, operation and maintenance of these services under wartime conditions. In some cases, descriptive details which might otherwise be included and photographs (particularly aerial views of industrial plants) have been omitted by the editors to avoid any possibility of releasing information to the enemy. Such omissions have not impaired the value of any of the discussions, for it has always been HPAC's policy to avoid purely descriptive articles or testimonial write-ups. Our aim is to present information of real value to HPAC's readers, using any specific installation merely as an example of the important principles. Not only do this month's articles provide information for your use and assistance; an incidental feature of them is their demonstration of the importance of heating, piping and air conditioning in industry and large buildings in wartime as well as in the days of peace. . . . The Journal Section of the American Society of Heating and Ventilating Engineers—published each month in HPAC—has a fine selection of papers, including several of those to be presented at Philadelphia. . . . Rounding out this month's offering are the regular departments, with news of equipment developments, trade literature, books and booklets, coming events and other items of interest in heating, piping and air conditioning work. . . . We hope you like it!

SABOTAGE PRECAUTIONS GO INTO EFFECT

In addition to increased safeguards against possible sabotage which went into effect throughout the nation's industrial plants on the outbreak of war, managers of many commercial and institutional buildings also are taking precautions against any dirty work. One theory holds that agents of enemy powers may try to cause, at some one time, as much damage or confusion as possible and wherever possible in order to hamper and delay American business, cause suspicion among ourselves, and generally jam up anything that would cost us time, money or peace of mind.

At some buildings, plans and orders had already been formulated to go into effect the day war started. Precautions include the locking of all points of entrance to buildings (covers on coal manholes, for instance), locking elevator and equipment penthouses, alertness on the part of operating staffs against (for example) explosives in the coal pile, regular inspection of fire extinguishers to be sure they are in proper working order and have not been tampered with, etc. Specific things to consider will vary in each building, but it's better to be safe than sorry.

Among the government booklets which have been issued recently is one on Protective Construction, prepared by the War Department,

Eight Ways that DEFENSE SAVINGS PAY ROLL ALLOTMENT PLAN HELPS Your Country — Now and Later

1) **It provides money now for vital military equipment.**
2) **It gives every American wage earner the opportunity for financial participation in national defense.**
3) **By storing up wages, it will reduce the current demand for consumer goods while they are scarce, thus retarding inflation.**
4) **As it succeeds in retarding inflation, it will reduce the cost of all materials, including defense materials.**
5) **As it succeeds in reducing the cost of defense, it will reduce emergency taxes.**
6) **It reduces the percentage of defense financing that must be placed with banks, thus putting our emergency financing on a sounder basis.**
7) **It builds a reserve buying power for the post-war purchase of civilian goods to keep our factories running after the war.**
8) **It will help reduce the ranks of the needy during that inevitable period of post-war readjustment.**

THE EDITOR'S PAGES

published by the Office for Emergency Management, and available for 25c from the Superintendent of Documents, Washington, D. C. It covers aerial attack and measures of defense against it—including protection of buildings, protection of utilities and industrial plants, and design and ventilation of air raid shelters. There is also a pamphlet issued by the United States Office of Civilian Defense on Protection of Industrial Plants and Public Buildings; it is devoted to the protective organization, fire services, police services, medical services and maintenance services.

TWO NEW NAMES ON HPAC'S BOARD

Two names appear for the first time this month in the membership of HPAC'S board of consulting and contributing editors, given on our contents page. They are not new to HPAC's readers, however, for both Kalman Steiner and E. A. Tyler have written several articles for our pages.

Mr. Steiner, consulting engineer with the Ray Heat & Power Co., has contributed many valuable discussions on oil burning and handling, temperature control, fuel conservation, piping and pumping oil, etc. He is also the author of an excellent text book on oil burners, and a new oil burner service manual written by him will be published soon.

Mr. Tyler, a man of wide experience in building construction and management, has the title of rental manager of the First National Bank building, St. Paul, but his duties and interests embrace many subjects in addition to renting office space. During 1941, we published three well-received and practical articles by him, and we are looking forward to more.

It is with sorrow that the name of Homer R. Linn is omitted from the editor's board this month. Mr. Linn died just as our December issue was going to press.

CHICAGO EXHIBIT IS CANCELLED

The board of directors of the Refrigeration Equipment Manufacturers Association has cancelled the 1942 "all-industry" refrigeration and air conditioning exhibition scheduled for January 12-15, in Chicago. The action was taken at a special board meeting held December 11.

In place of the formal exhibition an alternative arrangement is proposed under which the exhibitor companies will be able to contact the members of the industry and trade during the annual conventions and meetings of the cooperating organizations and the defense activities day tentatively set for January 13.

BOILER MAKERS MEET

Pledging their full cooperation in the war, members of the Institute of Boiler and Radiator Manufacturers at their annual meeting in New York on December 9 and 10 discussed the conservation of critical defense metals and fuels and the conversion of foundries into armament production.

A substantial increase in boiler and radiator sales in 1941 was reported by R. E. Ferry, general manager of the institute.

Members of the institute voted to continue the activities of all committees without interruption during 1942. One of the problems which will be studied at the University of Illinois is the effect on the environment obtained by placing radiators on inside walls for defense housing. Location of radiators on inside walls makes shorter pipe runs possible and involves a saving in materials and labor. Another problem which will be investigated is the connecting up of two radiators in series with only one return line. This method is being used by some contractors who claim good results.

The York Ice Machinery Corp. announced last month that during its fiscal year ended September 30, 1941, orders booked equalled $27,464,938, an increase of 64 per cent over the previous year. Sales complete and reflected in the earnings statement amounted to $19,817,282, a 22 per cent increase. Net income after all charges including taxes for the year ended September 30, 1941, amounted to $1,202,133, compared with $483,121 the year before.

NICKEL PRODUCTION AT NEW HIGH

World nickel production and consumption in 1941 were at an all-time high, according to a statement issued last month by Robert C. Stanley, chairman and president of the International Nickel Co. of Canada, Ltd. The sharp increase in demand arose from the joint British, Canadian and United States war effort.

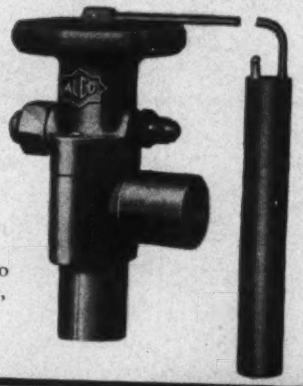
The United States consumed over two-thirds of the world's total nickel output in 1941, as contrasted with an average annual consumption of about one-third during recent years. It is estimated that steel mills in the United States are currently consuming approximately 70 per cent of the refined nickel imported into the country. Of the remaining 30 per cent, foundries are taking 7.3 per cent, brass mills 6.5 per cent, heat resisting and electrical resistance alloys 4.6 per cent, electroplaters 2.5 per cent, and the balance is required for rolled nickel and high nickel alloys and a variety of other products, he said.

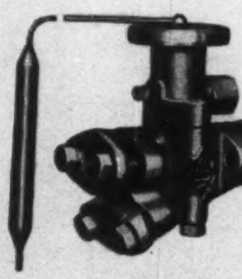
ARMY CONSTRUCTION GOES TO ENGINEERS

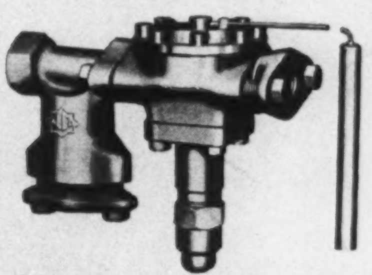
Authority for consolidation of all army construction under the corps of engineers was granted by an act, public 326, of the 77th Congress, which was signed by President Roosevelt December 1. Under the provisions of the act, the corps of engineers becomes the sole agency for army construction. All activities and personnel of the construction division, office of the quartertermaster general, are to be taken over by the corps of engineers. Architects, contractors and engineers should immediately benefit from this consolidation since they will be able to deal with the decentralized field organization of the corps of engineers, according to the chief of engineers. Much authority has been delegated to the 11 divisional and 51 district engineer offices located in all parts of the country.

THERMO EXPANSION VALVES

Type B—Thermo Valve. ½ ton Freon, 1 ton Methyl Chloride.


Type THL—Thermo Valve. 50 tons Freon, 100 tons Methyl Chloride.


Type TG—Thermo Valve. From 1 to 19 tons Ammonia.


Type FR4—Thermo Valve. From 26 to 60 tons Ammonia.

THE COMPLETE ALCO LINE

Covers the Field of Refrigerant Control

● Whatever your requirements in the wide field of refrigerant control, there is an Alco Valve that correctly meets the demands of the job. From the smallest to the largest air conditioning or refrigeration installations, the proper Alco engineered refrigerant control will materially contribute to the efficiency of the system.

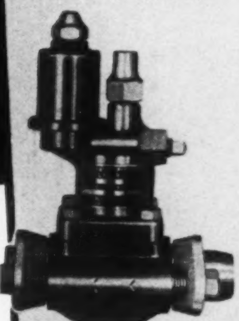
You'll find proof of Alco's leadership in the performance record of thousands of Alco Valves in operation on every type of installation throughout the world today. Alco Valves, plus Alco's engineering experience and extensive knowledge of control problems provide a combination that is second to none in the entire industry.

The complete Alco Line includes Thermostatic Expansion Valves, Automatic Expansion Valves, Magnetic Stop Valves, Evaporator Pressure Regulators, Float Switches and Float Valves — in a wide variety of types, sizes, and capacities.

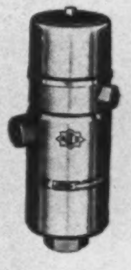
Alco offers you the most accurate, dependable refrigerant controls available today—designed for long life and completely satisfactory service.

ALCO VALVE COMPANY, 2622 Big Bend Blvd., St. Louis, Missouri
New York — Chicago — Seattle — San Francisco — Los Angeles

EVAPORATOR PRESSURE REGULATORS

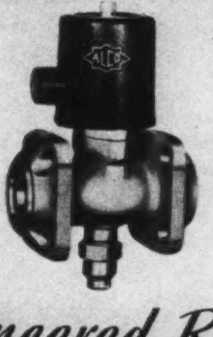

Type EPR — All Refrigerants. Port sizes up to 2 inches.

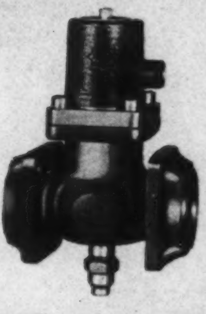
FLOAT SWITCHES


Type J—Liquid Level Control for All Refrigerants.

MAGNETIC STOP VALVES

Type S1—Magnetic Valve. 3 tons Liquid Freon, 6 tons Liquid Methyl Chloride.


Type R—Magnetic Valve. Liquid—35 tons Freon, 70 tons Methyl Chloride. Suction—9 tons Freon, 18 tons Methyl Chloride.


Type R — Magnetic Valve. Liquid—172 tons Ammonia. Suction—28 tons Ammonia.

Type SP— Magnetic Valve. 3 tons Liquid Ammonia.

ALCO *Engineered Refrigerant Controls*

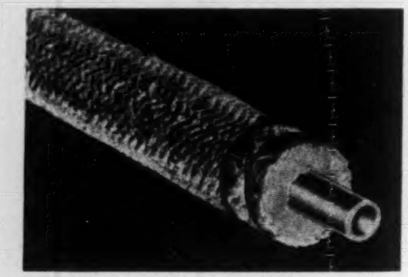
FOR HIGHEST EVAPORATOR EFFICIENCY

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page.

Pipe or Tubing Insulation

No. 2209—Problems encountered in insulating small-diameter heating lines on large airplanes have resulted in development of a new product known as "Insutube." Light weight, small size, and ability to stay put under severe shock and vibration are listed by its maker as its features which promise to have wide appeal for many industrial installations where small pipe or tubing is used to carry hot gases or liquids.



The material is made in the form of a seamless braided tube of long fiber asbestos with a wall thickness of ½ in. and is offered in a choice of sizes to fit pipes 1 in. ID and smaller. It is supplied either plain or with a water and grease repellent coating. In applying, the insulation is slipped on before assembly and is clamped at either end after being stretched tightly lengthwise on the pipe. Simple wire clamps are available or any ordinary hose clamp can be used.

The standard grade is recommended by the maker for temperatures up to 500 F, and special material can be supplied for higher temperatures.—Union Asbestos & Rubber Co., 1812 S. 54th Ave., Cicero, Ill.

Cleaning Air Cleaners

No. 2210—The electrostatic precipitator is the answer to many air cleaning problems in public buildings and factories. But, as it has grown to very large sizes and is used in places where it must not be shut down, it has developed a serious problem of its own: how to be rid of the mass of dirt it traps from the air. In steel mills, for example, turning out defense materials, the ventilating air for vital motors cannot be interrupted for air cleaner maintenance.

A new semi-automatic device now cleans the "Precipitron" electrostatic air cleaner with a brief service interruption to only a small section at a time. A 100 cell array of precipitator plates is divided into five 20 cell sections. The section to be cleaned is placed in front of one of these sections which is disconnected from the ventilation system and from the power supply. The cleaner has a motor driven carriage that sweeps slowly up and down in front of the dirty precipitator plates. The carriage has three horizontal rows of nozzles from which water, air and oil are sprayed in turn over the plates. The operation then stops, having lasted but 30 min. All the operator needs to do is to start it and a half-hour later return and move it to the next section. —Westinghouse Electric & Mfg. Co., Cleveland, Ohio.

For Your Convenience

Heating, Piping and Air Conditioning, [1-42]
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature."

(Circle each number in which you are interested)

2209	2210	2211	2212	2213	2214	2215	2216	2217	2218
2219	2220	2221							
4067	4068	4069	4070	4071	4072	4073	4074	4075	4076
4077	4078	4079	4080	4081	4082	4083	4084	4085	4086
4087	4088	4089	4090	4091	4092	4093			

Name............................ Title...... ....

Company ....

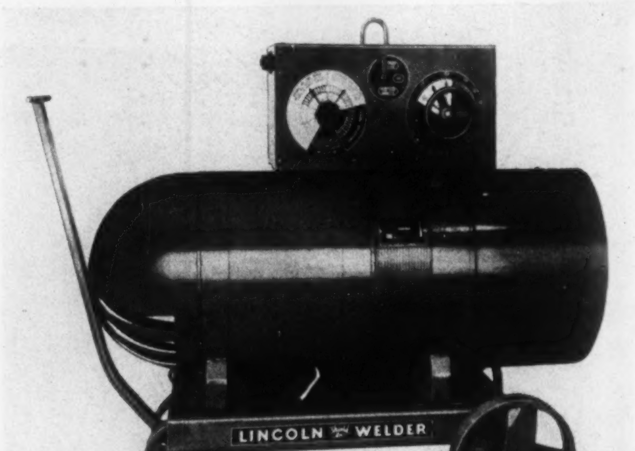
Address ....

City............................ State..................

Arc Welder Control

No. 2211—Improved and simplified design of the "Dual Continuous Control" for arc welding machines which eliminates the need for meters showing volts and amperes has been announced.

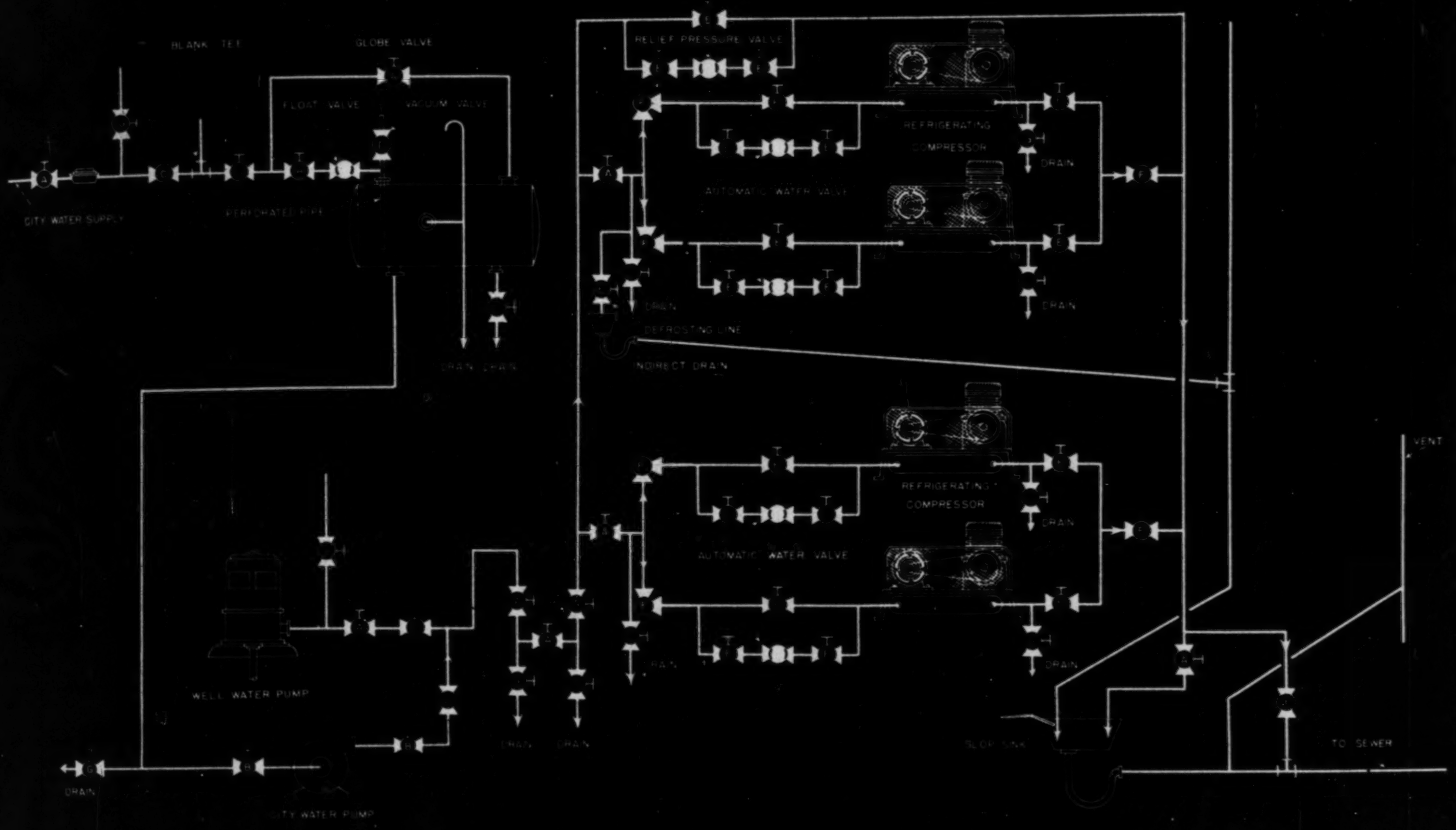
These welders have both job selector and current control calibrated and equipped with dials which indicate the type of work and the number of amperes for each setting. It is claimed by the maker that this feature enables the welding operator to secure high quality welds and high welding speeds because he can vary both the slope of the volt-ampere curve and the amount of



GOOD VALVE PRACTICE

A TYPICAL REFRIGERATION LAYOUT

Separate Units using Well Water Cooling


BLANK TEE
GLOBE VALVE
FLOAT VALVE
VACUUM VALVE
CITY WATER SUPPLY
PERFORATED PIPE
DRAIN DRAIN
RELIEF PRESSURE VALVE
REFRIGERATING COMPRESSOR
AUTOMATIC WATER VALVE
DRAIN
DRAIN
DRAIN
DEFROSTING LINE
INDIRECT DRAIN
REFRIGERATING COMPRESSOR
AUTOMATIC WATER VALVE
DRAIN
DRAIN
DRAIN
VENT
WELL WATER PUMP
DRAIN DRAIN
SLOP SINK
TO SEWER
DRAIN
CITY WATER PUMP

Jenkins SUGGESTS

This layout is typical of modern fur or food storage plants where small units are located on separate floors. There is an entire system using well water cooling, with an auxiliary city supply and defrosting connection, as shown.

Here, as well as in any other layout, good valve *practice* calls for good valve *design.* And for the best in valve design you can't do better than specify "Jenkins". Actual service records prove that Jenkins Valves last *longer* – cost *less* – and give you *more dependable* service.

You will find this superior quality throughout the complete line of Jenkins Valves – covering every heating, piping and air conditioning service. *And this superior Jenkins quality costs no more!*

JENKINS BROS., 80 White Street, New York, N. Y.; Bridgeport, Boston, Atlanta, Philadelphia, Chicago, Houston. Jenkins Bros., Limited, Montreal, Canada; London, England.

REFERENCE CHART FOR JENKINS FIGURE NUMBERS

A	HEADER GLOBE	Fig. 141	IBBM
B	HEADER GATE	Fig. 651	IBBM
C	HEADER CHECK	Fig. 151	IBBM
D	ANTI-CONTAMINATION CHECK	Fig. 294	IBBM
E	EQUIPMENT GLOBE	Fig. 106-A	Bronze
F	EQUIPMENT CHECK Horiz. Angle	 Fig. 117-A Fig. 118-A	 Bronze Bronze
G	PIPE DRAIN GLOBE	Fig. 106-A	Bronze
H	TANK DRAIN Y VALVE	Fig. 124	Bronze
I	SEWER CHECK	Fig. 623	IBBM

In this typical layout of a refrigerator system for cold storage plants, refrigeration is accomplished by individual water-cooled freon units, with basic cooling water supply furnished by an artesian well. Ah emergency auxiliary supply of city water is also provided; it is protected against contamination from the well water supply by means of a check valve. All piping passes through refrigerated space. Drains and shutoff valves are provided at frequent intervals so that in the event of shut down of the system the lines can be drained to eliminate danger of freeze-up. The drain valves provided after the compressor not only serve as drains but also as a method of testing the quantity of water through the compressor.

#12
OF A SERIES
designed to help in selecting
JENKINS
VALVES

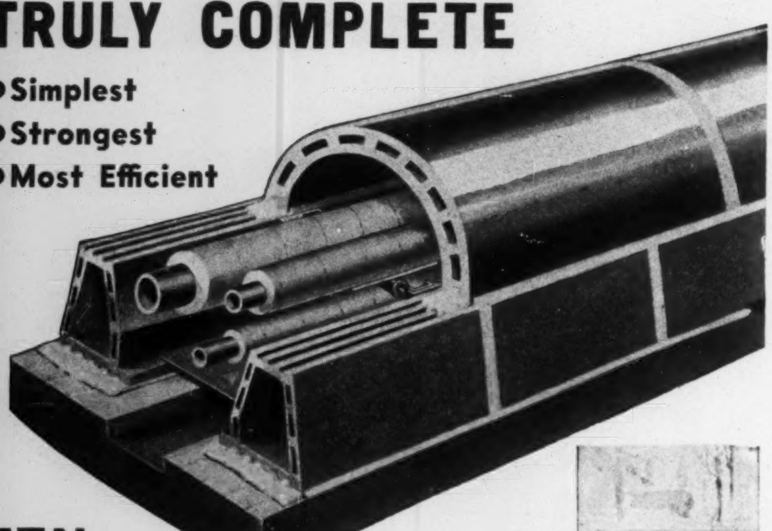
Diagram by
Huxley Madeheim,
Consulting Engineer

NKINS VALVES . . . BRONZE, IRON, STEEL . . . FOR EVERY NEED!

THERM-O-TILE
REG. U. S. PAT. OFF.

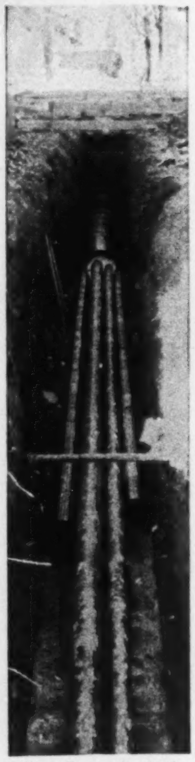
The only underground pipe conduit that is
TRULY COMPLETE

- Simplest
- Strongest
- Most Efficient



TEN
THERM-O-TILE ADVANTAGES

1. Less excavation is required for Multiple Pipe Systems than with other conduits.
2. Installation work can be started immediately since the tile is not required on the job until after the pipe has been installed and tested.
3. Pipe is supported on a solid concrete foundation which will hold permanently to a specific grade level. No condensate pockets.
4. Pipe is installed on concrete foundation with no interference of tile or other trades working in trench at the same time.
5. Conduit is installed with an internal drain in the concrete base which allows no accumulation of water in conduit due to steam leaks or water seepage through conduit.
6. Internal drains are connected through the manholes and not on the outside of manholes. This permits periodical inspection of drains for any possible leaks.
7. Due to the arch construction of the conduit, greater loads can be carried on top of the conduit than with round tile or other shapes.
8. Since no bell joints are used in the tile construction, Therm-O-Tile can be easily waterproofed with membrane waterproofing.
9. Repairs to steam line easily made by removal of top and side tiles at point of repair.
10. Greater thermal efficiency is secured since the insulation is surrounded by air rather than by the heat-conducting damp earth.

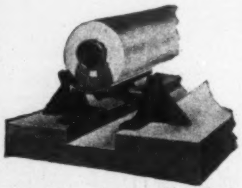


Filler Type Insulation is used here—at a large N. J. State Hospital.

In addition Therm-O-Tile is durable; permits movement of lines for expansion and contraction without harm to the pipe or insulation; cave-ins and inclement weather cause less damage and expense. And so on. Most of the advantages are fully covered in Bulletin 381. Ask for a copy.

Complete Data and Estimates on Request.

H. W. PORTER & CO., Inc.
822-H Frelinghuysen Ave.
Newark, New Jersey

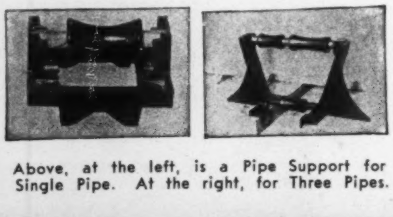


The above shows a Pipe Saddle. Permits full thickness of insulation between pipe and roller.

Sold and installed by Johns-Manville Construction Units in all Principal Cities.

See our page in Sweet's or The Heating Guide.

A typical example of Sectional Pipe Insulation.



Above, at the left, is a Pipe Support for Single Pipe. At the right, for Three Pipes.

H. W. PORTER & CO., INC.
NEWARK — BALTIMORE — WASHINGTON — RICHMOND — CHARLOTTE

welding current independently and positively to suit every job encountered.

Another feature of this welder control is that both voltage control (job selector) and current control are continuous in operation. This design provides literally thousands of possible combinations of voltage and current. It is claimed that this simplifies the setting of the control and accounts for an exceptionally wide welding range as to types of work, welding conditions, sizes of electrodes and thicknesses of material.

An important advantage made available by this design development is the ability to positively reverse polarity.—Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

Metal Duplicating Without Dies

No. 2212—A versatile and flexible method of making small metal parts in limited quantities is made possible by the use of the "Di-Acro" bender, brake and shear. These precision machines do the work rapidly and are accurate to 0.001 in., says the manufacturer.

The illustration shows the three typical steps in this process. First, the man at the right is cutting strips from a stock sheet to the required size with the shear. Second, the operator in the center is forming a channel from the strip with the brake. Third, the last man is putting a bend on each end of the channel with the bender.

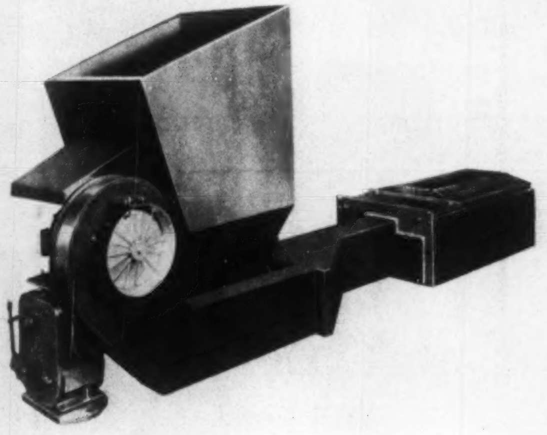
These bends can be of varying radii, and the two bends are shown on opposite sides of the channel, one with the channel turned out and one with the channel turned in. The finished piece represents a composite of many accurately formed parts found in small electrical and mechanical assemblies and manufacturing processes.

These three machines comprise a system of almost unlimited possibilities for metal duplicating without dies, yet retaining die accuracy. The bender also handles round, half-round, square or flat wire, round or square tube, rod, etc. All the machines are adapted for either right or left hand operation.—O'Neil-Irwin, Inc., 316-8th Ave., S., Minneapolis, Minn.

Redesigned Stokers

No. 2213—A redesigned line of commercial and industrial underfeed screw type stokers incorporates hopper and bin feed models, with clinker type burners (shown) or with side dumping grates; sizes range from 200 to 850 lb per hr of coal.

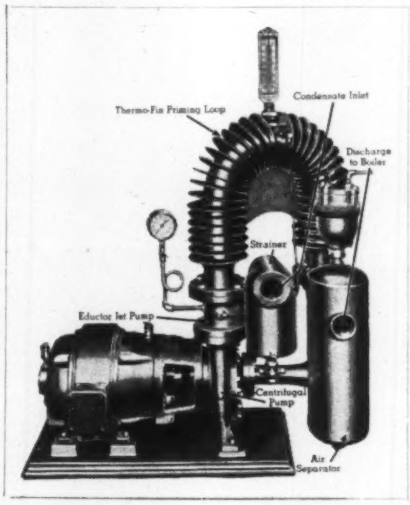
They are equipped with large, heavy duty, three speed automotive type transmissions, oversized motors and fans, states the maker. Totally enclosed windboxes and stoker fronts are provided to assure airtight air chambers and to reduce installation expense. Two doors in the stoker front provide for positive windbox cleanout.



They have full active self-contained burning ends made up of segmental type tuyeres which are interlocking to eliminate danger of their becoming loose in the fire.—Frederick Iron and Steel Co., E. 7th St., Frederick, Md.

Condensate Return System

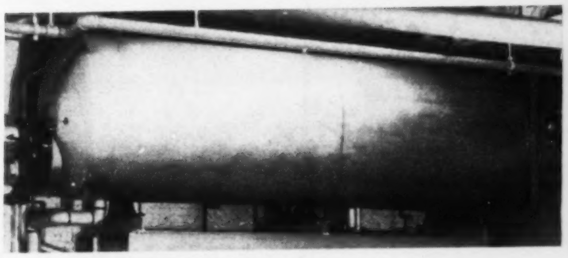
No. 2214—The essential engineering features of the "Cochrane-Becker" high pressure condensate return system, says the maker, are that its eductor principle of operation insures thorough condensate and air removal from process apparatus, making increased production possible by maintenance of uniformly high temperatures.



Then, after expulsion of the air from the closed circuit, the condensate is returned to the boiler at temperatures close to that of the process pressure without flash loss and with fuel savings.

The special centrifugal pump draws water from the fin priming loop and discharges it as a high velocity jet through the jet pump nozzle. This jet, striking the returned hot condensate, induces condensate flow through the mixing tube into the priming loop. The additional volume of the returned condensate introduced into the

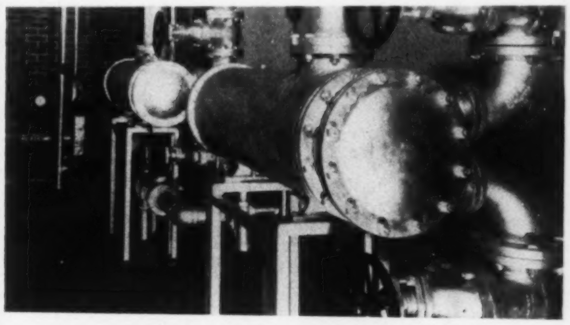
WHITLOCK



WRITE FOR BULLETIN 40

STORAGE WATER HEATERS

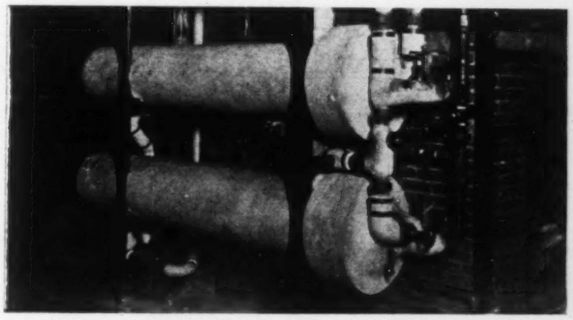
Whitlock Type K Heaters are found wherever hot water is used in large quantities—industrial plants, institutions, hotels, and laundries. Specified by leading engineers.



WRITE FOR BULLETIN 20

INSTANTANEOUS HEATERS

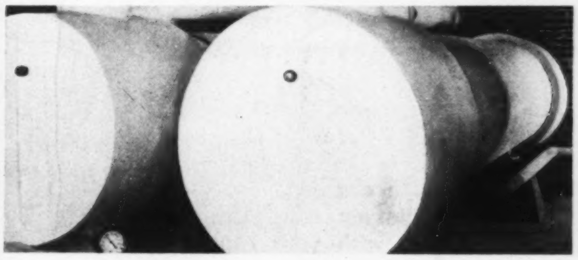
Straight tube, U-tube, and coil tube designs. Heating water for storage; for heating systems (convertors); and other uses requiring hot water at a uniform rate.



WRITE FOR BULLETIN 31

FUEL OIL HEATERS

Preheating fuel oil reduces viscosity, improves atomization, raises efficiency. Service records at hundreds of plants endorse Whitlock Fuel Oil Heaters. Straight, U-, and coil tube designs.



WRITE FOR FULL INFORMATION

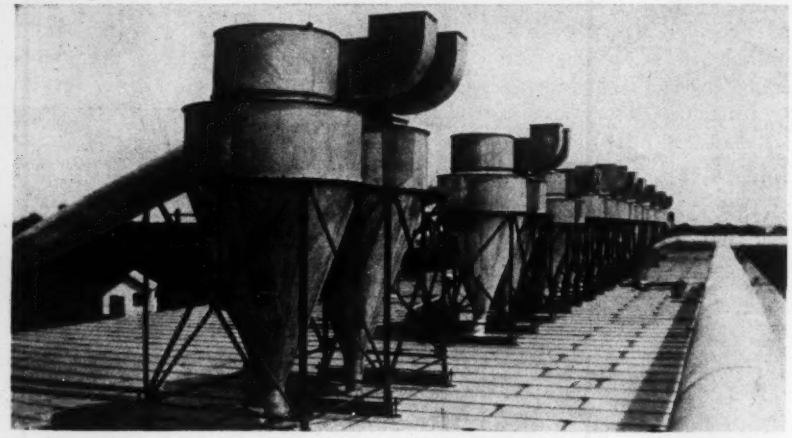
WATER CHILLERS

For use with Freon, Methyl Chloride, and Sulphur Dioxide are good examples of Whitlock Heat Exchangers for air conditioning service. Variety of designs available.

Send complete information if quotation is desired.

THE WHITLOCK MANUFACTURING COMPANY

44 South Street, Elmwood, Hartford, Connecticut
District Offices in New York, Boston, Chicago, Philadelphia, Detroit, Richmond



A BATTERY OF DAY DUAL-CLONE DUST COLLECTORS USED IN A RECENT COMPLETE INSTALLATION

DAY Dust Control Systems and equipment co-ordinated for modern needs are guaranteed to give predetermined results.

DAY equipment and service are recognized as "Tops" in its line.

DAY experience has been acquired through

OVER 60 YEARS OF PROGRESS.

The broad experience of our Engineering staff is available to assist you in an economic and efficient solution of your dust and fume control problems.

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"It's the Best you can use and Easy to Work"

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Whatever you demand of copper—easy workability . . . corrosion resistance . . . forming qualities . . . easy soldering, brazing, welding—you'll find them all in *Hussey* Copper. It's Pure Lake Copper—the best you can use. Call *your* local Hussey warehouse for assistance with your copper problems.

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Rolling Mills and General Offices: PITTSBURGH, PA.

WAREHOUSES IN CHICAGO, CINCINNATI, CLEVELAND, PITTSBURGH, NEW YORK, PHILADELPHIA and ST. LOUIS

constantly filled loop results in the discharge of an equal volume through the air separator to the boiler.

The closed circuit from the boiler, through the process equipment, and back to the boiler results in quick and uniform heating and hence increased production and improved quality, it is stated, at the same time eliminating flash loss and providing 1 per cent fuel saving for each 11 deg temperature gain.—Cochrane Corp., 3161 N. 17th St., Philadelphia, Pa.

Rust Preventer

No. 2215—"Aqua-Clear" is a new product designed to prevent rust and provide clear water from metal tanks or pipes. It also clears out loose rust from old, rusty tanks and pipes, says the maker. The product is a liquid which is added to the water as it is put into the system. —Sudbury Laboratory, South Sudbury, Mass.

Welding Aid

No. 2216—A manufacturer of thermometric pellets has announced a new, convenient form of his product, called "Tempilstik°." Like the pellets, they have a specified melting point and are available from 125 F to 1600 F, in convenient temperature intervals. Mean accuracy is within 1 per cent of the temperature stamped on each stick or pellet, it is stated. Thus a "300 Tempilstik°," drawn across a surface heated to less than 300 F, will leave a chalklike mark which melts sharply into a liquid streak when the surface reaches 300 F.

The pellets and the new "Tempilstiks°" provide a simple and convenient method of signalling desired preheating temperatures in the welding of steel, special alloys, cast iron and non-ferrous metals; and in local heating, heat treatment and fabrication of metals generally.

The new "Tempilstik°" offers a means of leaving a temperature signal mark on less accessible places, such as vertical, inclined and overhead surfaces. Properly used, each stick will yield up to 1000 temperature determinations, says the maker.—Tempil Corp., 132 W. 22nd St., New York, N. Y.

Limit Control

No. 2217—A new limit or operating control for hot water heating systems is easy to mount, as the trough-shaped base permits a snug fit in direct contact with hot water pipes, the maker states. The mounting requires only fastening of a metal strap to hold the control to either horizontal or vertical pipes.

HOT WATER
CONTROL

The mounting base and the thermal element are one and the same part in order to simplify design and to assure immediate response to changes in boiler water temperature.

Temperature cut-out setting is made without removing the cover. Available for low or line voltage circuits, and in direct or reverse action models. — Perfex Corp., 500 W. Oklahoma Ave., Milwaukee, Wis.

DOUBLE PROTECTION

for air-conditioning ducts when they're lined with

J-M AIRACOUSTIC SHEETS

AGAINST NOISE . . . You'll be guarding against complaints about noise in your air-conditioning installations if you line ducts with J-M Airacoustic Sheets. This modern material soaks up 70% of all noise that strikes it. And its cost is so low that you can include duct quieting in every estimate.

AGAINST FIRE : : . Air-conditioning systems lined with J-M Airacoustic Sheets are safer. Because this modern material is basically mineral, it will not flame . . . introduces no fire hazard. Your clients will appreciate this extra protection.

• • •

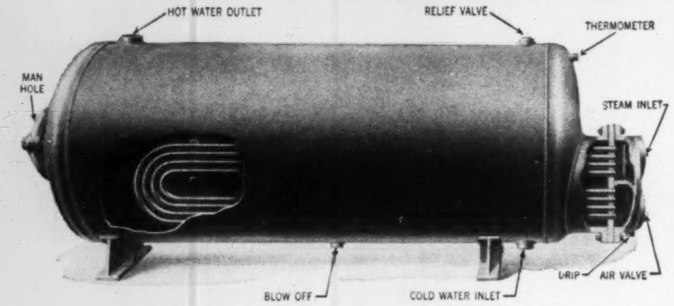
YOU CAN USE J-M Airacoustic Sheets for lining any type of duct. They are light and easy to handle . . . simple and economical to apply. On the job, their unusual moisture resistance offers protection against humidity . . . keeps maintenance at a minimum. For details, write for brochure AC-23A. Address Johns-Manville, 22 East 40th Street, New York, N. Y.

JOHNS-MANVILLE JM PRODUCTS Johns-Manville

AIRACOUSTIC SHEETS

FOR DUCT LININGS

UNCONDITIONALLY GUARANTEED!



We admit that is a strong statement — and we'll back it to the limit. Installations of Patterson Hot Water Heaters, made according to our recommendations, will be unconditionally guaranteed to furnish all the hot water required for the purpose intended. And 60 years of experience in heat exchange engineering is in back of that guarantee!

Patterson Hot Water Heaters are tailor-made to fit the requirements of the particular installation or industry. They can be made in special alloys or metals, or copper-lined as the situation demands. And they are designed to give the maximum amount of hot water in the minimum length of time — all the hot water necessary for the specific job — delivered on time!

Patterson-Kelley engineers will be glad to discuss your hot water heater installation problems. No obligation, of course. Why not drop us a line today?

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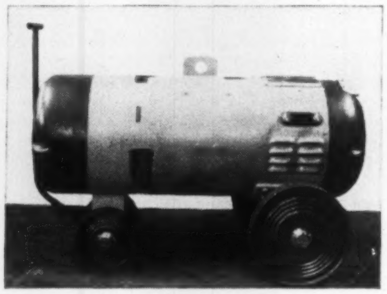
PATTERSON HOT WATER HEATERS

THE *Patterson-Kelley* CO., INC.
107 WARREN ST., E. STROUDSBURG, PA.

Portable Welder

No. 2218—For all-purpose welding in industrial plants, shipbuilding and for general maintenance work, a new portable "Flexarc" welder has been announced. Attractively finished in blue and gray, the enclosure is made of a one piece weatherproof steel frame mounted on a four-wheel running gear. Ratings are 200, 300 or 400 amp for 220, 440 and 550 volt a-c circuits; two and three phase, 25, 50 and 60 cycles.



Current adjustment is obtained by a ball crank, making it possible to preset the desired current before welding. Steady current regardless of arc length is provided by arc control which can be adjusted to suit the welding job, the maker says.

In operating, a magnetic shunt is placed in the armature reaction flux path. Output current of the welding generator is adjusted by ball crank control of the position of a laminated iron leakage block. This block serves as a magnetic shunt for the reaction flux of the machine, and its position with respect to the main flux path determines the welding current. By this principle, no field rheostat exciter or external reactor is required.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Water Column Try-Cocks

No. 2219—The new "Y.H.D." try-cock is built for modern high pressure service, is easy to operate and shuts off tight with no dripping, says the maker.

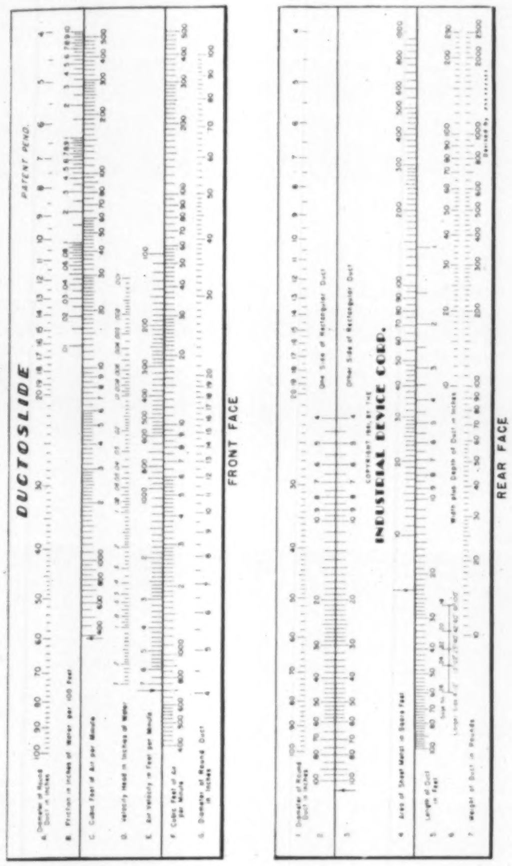
For pressures up to 600 psi, body and stem are tobin bronze; for 600 to 1500 psi, these parts are stainless steel. Shanks are stainless steel. Needle valve and seat are stainless steel, heat-treated, and these parts are reversible and renewable.

To avoid interference of operating chains, the operating lever on upper try-cock is offset outward, the lever on the center try-cock is straight and the lever on the lower try-cock is offset inward. Also made in weighted lever style with single operating chains.—Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.

Slide Rule for Duct Design

No. 2220—A slide rule recently developed for solving problems in duct design in ventilating and air conditioning is known as the "Ductoslide." According to the manufacturer, it contains all the data necessary in the design of an air distribution system and provides an instrument for practical help in daily work. It may be used to design either by the friction, velocity or some other method.

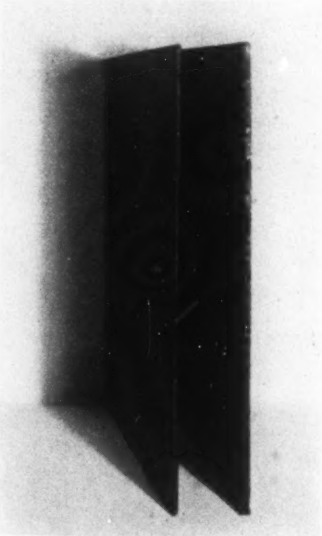
In addition to the scales for sizing ducts, the device also has scales by means of which the area of sheet metal for a given duct and its total weight with respect to various gages of sheet metal can be readily determined. In developing these scales an allowance for seams was made in accordance with standard field practice.



Overall dimensions are 10 in. x 2¼ in. x ¼ in. and a leather carrying case is provided.—Industrial Device Corp., 501 Fifth Ave., New York, N. Y.

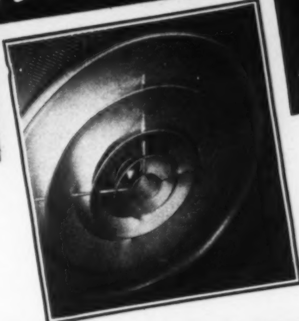
Asphalt Board for Ducts

No. 2221—A new asphalt mastic board, designed for duct work in industrial air conditioning and warm air heating systems, has been announced.



The product is composed of a high melting point asphalt in combination with fine mineral aggregate, sealed between dry nonbleeding liners to provide a waterproof, rigid non-warping board, says the manufacturer. Both acid and alkali resistant, it may be formed into various shapes. The board is available in thicknesses from $\frac{1}{16}$ to ⅛ in., widths up to 48 in., and in any length desired.

The company is also offering a reinforced sheet. — Keystone Asphalt Products Co., 43 E. Ohio St, Chicago, Ill.



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Blaze in Retail Store's Air Conditioning System Gives Fire Safety Data

WITH air conditioning being provided in an increasing number of plants and other structures erected as a direct or indirect result of the defense program, the importance of installation specifications which assure adequate protection against fire hazards should receive general recognition. Observations based on a recent fire in the large Tiedtke retail store, Toledo, Ohio, lead to conclusions of interest. Here a fortunate combination of circumstances made it possible to empty the store of 10,000 customers without panic or injury and to minimize smoke damage to perishable merchandise. The experience provided lessons that have enabled the store further to improve the safety of its installation.

Tiedtke Installation

The Tiedtke store is a four story and basement structure, with brick walls and floors of joist construction. At the time of the fire only the first floor was air conditioned. The capacity of the system was 67,200 cfm of air. Outside and return air first passed at the rate of 300 fpm through 84 standard 20 in. by 20 in. cells containing 168 fiber glass filters and then over fin coils water cooled in summer and steam heated in winter. The filters were replaced every 90 days.

From the coils the conditioned air passed through a blower and was forced through horizontal ducts fastened to the ceiling and leading into various sections of the store. Openings of the discharge ducts were at the ceiling. There were no return ducts, but air from the store was drawn back into the air conditioning apparatus through return louvers opening into the restaurant. Openings of the return louvers were protected with 1½ in. mesh wire screen.

The fire occurred on one of the summer's busiest Saturdays, at a time when there were some 10,000 customers in the store. Shortly after one o'clock an official of the store noticed smoke issuing from a louver in the wall of the room where the air conditioning equipment was situated. Believing that a short circuit had occurred, he telephoned the engineer's office and immediately afterward observed a haze pouring out of the ducts.

Access Difficult

The manual controls for the louver openings and the control switch for the air conditioning system were in the plenum chamber, which by this time was filled with smoke and flame. The only other means of shutting off the system would have been to pull the main electrical switch which would have cut off all lights and elevators, an act that might have caused panic among the customers. Fortunately the chief engineer was able to work his way into the room housing the equipment and pull the fan motor control switch.

Then the sprinkler heads operated and extinguished the fire before the arrival of the fire department. Probably the heads did not let go sooner because the forced draft action of the air returning through the louvers prevented the heat from rising and a blanket of cooled air above the fire prevented the temperature at the level of the heads from reaching a point high enough to melt the sprinkler fuses.

In the meantime, thanks to the calm and efficient action of employees, the store was emptied of customers without disorder or panic. This exodus was accomplished without injury, even though smoke was spreading from floor to floor via the stairways. Department heads and personnel remained at their fire posts until every customer had left.

Filters as Barrier

The only direct damage by fire was to the interior of the air conditioning room and its equipment. To his insurance underwriters following the fire, E. J. Komarek, Tiedtke vice-president, reported that damage done to merchandise by the smoke was remarkably small because some of the carbon was removed from the smoke by the air filters. There was some damage from water and breakage, but the store was able to reopen for business within a few hours. More important, Mr. Komarek said that the air filters, which are coated with a non-inflammable dust stopping oil adhesive, acted as a fire barrier to prevent spread of fire through the ducts, and he credited them with preventing a catastrophe that might have been costly in lives and money.

Cause Unknown

The exact cause of the fire remains unknown. However, in view of the daily inspection of the mechanical equipment, and the fact that there was nothing in the air conditioning room that would be expected to ignite spontaneously, it is believed that paper napkins or other inflammable material may have been drawn through the return louvers which were situated in the restaurant at the floor level. These materials may have been ignited by a carelessly thrown cigarette.

The experience demonstrates that fire originating in air conditioning installations develops with great rapidity, and that even prompt extinguishment by automatic sprinklers is no assurance that smoke loss will not occur. The operation of the air conditioning equipment permits smoke to be simultaneously discharged at numerous points on a floor; or where the entire building is air conditioned, it permits the discharge of smoke simultaneously on all floors.

In the case of the Tiedtke fire the location of the return louvers at floor level made possible the easy introduction of inflammable material—paper, cigarette butts, matches and so forth. These louvers have since been relocated 7 ft above the floor. The louver and motor controls have been moved to the outside of the air conditioning room where they can easily be reached in an emergency.

Fire Safety Factors

W. W. Seidner, Tiedtke chief engineer, points out that the fire shows the following important factors should be considered in installing air conditioning equipment:

1) Automatic dampers should be provided on both sides of filter chambers. Consideration should be given to installation of an automatic motor stop operated by a device adjusted to detect smoke or heat, such as the electric eye.

2) Fine screenings should be provided at all return duct or louver openings to prevent inflammable materials from falling or being thrown into them.

3) Air filters should be of a type that will not burn.

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It is believed that the filters of the Tiedtke installation were helpful in minimizing smoke loss and reducing panic hazard.

4) Horizontal ducts should have a number of door openings so that ducts can be cleaned out at frequent intervals.

5) Remote control, at a point easily accessible in case of emergency, should be provided for louvers and motors.

6) All portions of the room housing the air conditioning apparatus should be equipped with sprinklers.

Fortunately the Tiedtke fire was discovered promptly and efficient action was taken to shut down the air conditioning system and clear the building. The resultant loss was small, but it might have been infinitely greater if the flames and smoke had prevented entry into the room where the control switch was situated. It is obvious that recognition of possible fire hazards and adequate provision to eliminate them are factors of primary importance in all air conditioning installations.

Fan Manufacturers Mark 25th Anniversary

Organized in February, 1917, the National Association of Fan Manufacturers will celebrate its 25th anniversary at the annual meeting to be held in Detroit February 12. Started primarily as a credit association, the scope of the activities has been gradually enlarged during the intervening years to include research, engineering standards, educational work in the proper uses of air moving machinery, improved working conditions and other allied subjects.

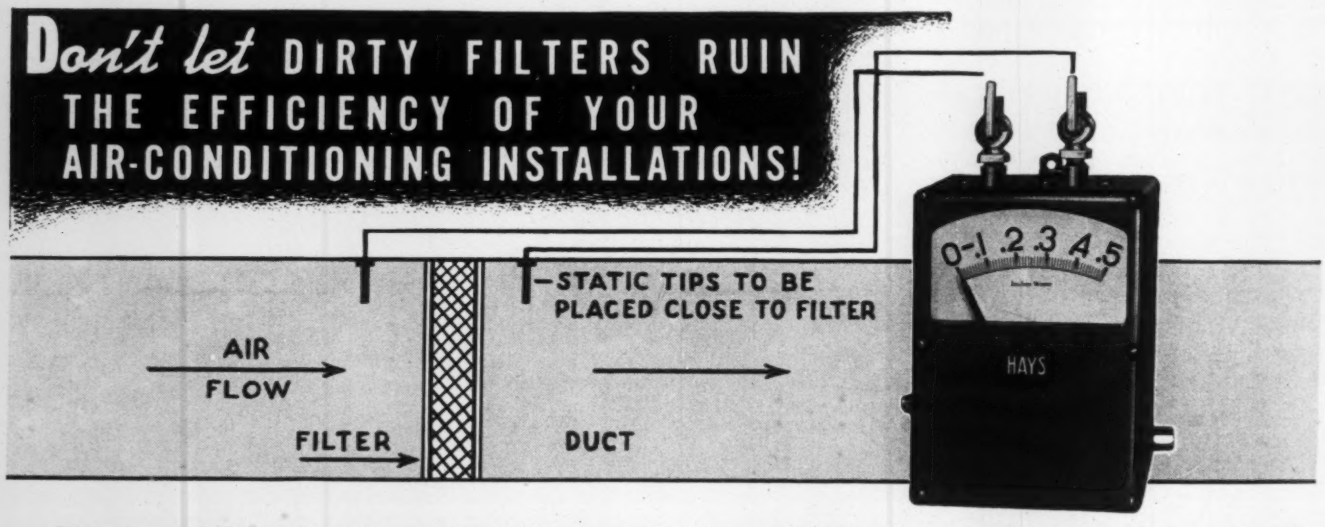
In cooperation with the engineering societies, the Standard Test Code for Centrifugal and Axial Fans was first sponsored by the association and published for distribution to the public. A certified rating label which may be attached to catalogs or products is now issued to member companies for identification to the buyer that fans sold thereunder have air deliveries obtained in accordance with the standard test code.

Research and study has been made of the effect of erosion, corrosion or the results of excessive heat as well as investigations covering the subjects of sound, air washers and field tests of fans.

A program of standardization has been adopted to cover those types of centrifugal fans designed for application in and furnished under specifications for the heating, ventilating and air conditioning fields.

Publications of the association available to the public include Standard Methods Adopted for Centrifugal Fans and Blowers, Standard Test Code for Centrifugal and Axial Fans, Comparison Charts for Planing Mill Exhausters and Cast Iron Volume Fans, Field Test of Fans, The Magic of Fresh Air and Electricity, and Abrasion.

Don't let DIRTY FILTERS RUIN THE EFFICIENCY OF YOUR AIR-CONDITIONING INSTALLATIONS!



Dirt clogged filters in any air-circulating system mean reduced efficiency and added power costs. On the other hand, changing filters oftener than necessary is downright waste.

With a HAYS Air-Filter gage installed in a duct you know precisely, at all times, the condition of the filter and Static tips, installed on either side of the filter bank supply a differential air-flow measurement which is indicated on a scale in the remotely mounted gage. If desired, the gage may be made to flash or sound an alarm when filter resistance becomes excessive. And it is also furnished when wanted with electric contacts to operate a damper to control the flow of air through the duct.

The HAYS Air-Filter Gage employs the famous slack-leather diaphragm pressure measuring element and is of the high quality in design, materials and workmanship that has made Hays Gages internationally famous. The price is reasonable. Write us at 990 Eighth Avenue for Publication 40-278.

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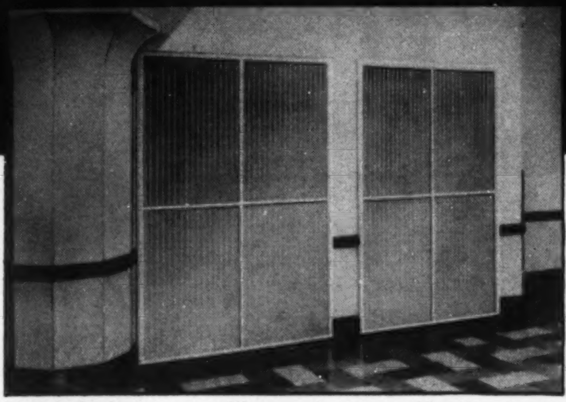
MICHIGAN CITY, INDIANA, U.S.A.



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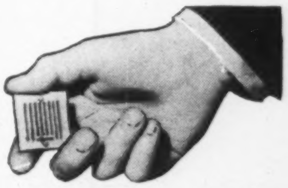

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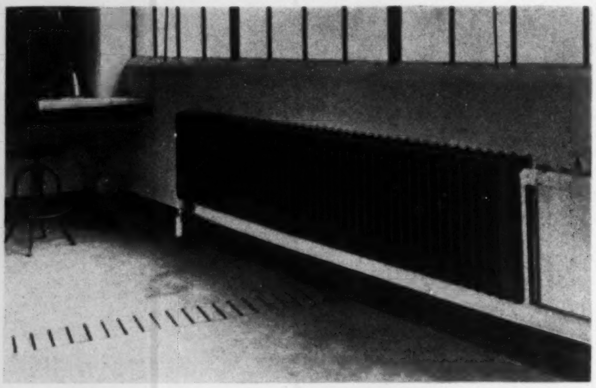

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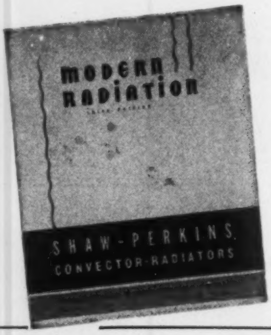

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Air Conditioning Equipment

No. 4067—Utility Fan Corp., 4851 S. Alameda St., Los Angeles, Calif. 6 p. bulletin on air moving equipment, gas fired heating equipment and evaporative air coolers including data on standard and heavy duty blowers, industrial exhausters, variable pitch propeller fans, blower sets, all year conditioners, etc.

Alloy Tubing

No. 4068—Babcock & Wilcox Tube Co., Beaver Falls, Pa. 157 p. technical bulletin (6-D) on the properties of carbon and alloy steel tubing for high temperature and high pressure service. A complete revision and enlargement of the previous edition, this bulletin includes new data on physical properties and behavior in service of the "B&W Croloys" and other materials. New sections have been added on the seamless tube manufacturing process, rupture testing, maximum allowable working stresses, steel for subzero application, effect of hydrogen, and air hardening properties. There is also a fully illustrated section on common causes of tube failure.

Bearings

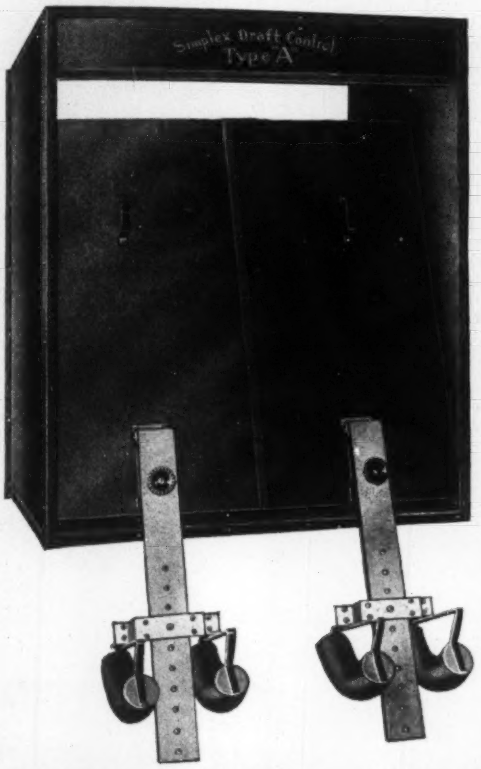
No. 4069—Johnson Bronze Co., 460 S. Mill St., New Castle, Pa. 36 p. catalog (L-3) on "Ledaloyl" self-lubricating bronze bearings and bushings in standard stock sizes. Aimed to serve designing engineers, this catalog lists more than 2000 standard sizes the use of which speeds delivery and eliminates extra costs of tools and dies.

Blower Wheels

No. 4070—Morrison Products, Inc., 16816 Waterloo Rd., Cleveland, Ohio. 4 p. bulletin on "Airstream" blower wheels for air conditioning and forced warm air heating, announcing the addition of a 14½ in. diameter wheel to the manufacturer's line. Among the features of the wheel is a blade section made in one continuous strip from coil stock by a progressive die operation. The method is used to eliminate chances of loose blades.

Boilers

No. 4071—Fitzgibbons Boiler Co., Inc., 101 Park Ave., New York, N. Y. Mailing piece entitled Report from the Front, illustrating the manufacturer's plant at Oswego, N. Y., and showing the extensive alterations and additions which have recently been completed.



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. . . . . . If the trouble is from dirt, the valve may be taken apart, cleaned, and reassembled. Typical dealer report: — "Was called on a job today . . . after a thorough cleaning the vents worked perfectly."

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Boiler Feedwater Treatment

No. 4072—Permutit Co., 330 W. 42nd St., New York, N. Y. 12 p. bulletin (2420) on supplementary treatment of boiler feedwater, presenting a complete discussion of the various ways in which a plant might feed chemicals to further condition the water after external water treatment. Particular attention is given to the advantages of phosphates and there are descriptions and diagrams of proportionating and non-proportionating phosphate feeds. There is also a section on feeding sodium sulphite for reaction with oxygen in the feedwater.

Dust Control

No. 4073—Day Co., 2938 Pillsbury Ave., Minneapolis, Minn. 16 p. bulletin on dust control in the grain handling and processing industry, reviewing 60 years of progress in this field and describing and illustrating in detail the features of the manufacturer's equipment and its applications.

Electrical Equipment

No. 4074—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 60 p. "Quick Selector" catalog on safety switches, no fuse breakers, multibreakers, panelboards, motor control and motors. This catalog, which is issued twice a year, is designed to simplify the selection of electrical equipment for any motor, lighting or feeder circuit. Important changes in the new revision are the addition

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of industrial multibreakers and the dropping of breaker enclosures made of aluminum. Also, there is a new rule for applying safety switches on continuous duty circuits having constant loads.

Electric Tools

No. 4075—Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. 68 p. catalog (37) on "Thor" portable electric tools including drills, screw drivers, nut setters, tappers, saws, hammers, nibblers, grinders, sanders, polishers and electric tool accessories. Illustrated with photographs of tools in operation on various types of work, this catalog is a helpful guide for the selection of proper equipment for different applications.

Fan Blades

No. 4076—Torrington Mfg. Co., 70 Franklin St., Torrington, Conn. Mailing piece entitled David and Goliath featuring the defense production capacities of the manufacturer from small fan blades to a giant slitter and trimmer for sheet aluminum.

Finishes

No. 4077—Roxalin Flexible Lacquer Co., Inc., 800 Magnolia Ave., Elizabeth, N. J. File folder giving information on U. S. government finishes, containing data sheets on widely used army and navy specification fin-

G&O COILS

G&O
RADIATION

Detail of mechanical joint used in Universal Heat Transfer Coils.

FOR HEATING AND COOLING IN A WIDE RANGE OF SIZES

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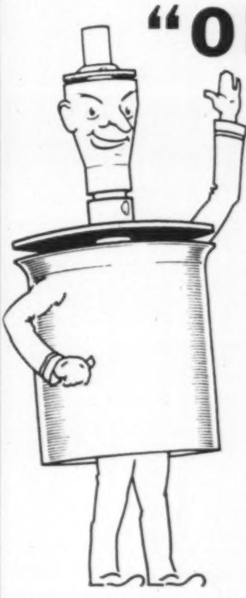
THE G&O MANUFACTURING COMPANY
New Haven, Connecticut
Pioneer Manufacturers of Square Finned Tubing in the United States

"ONE STOP" BURNER SERVICE



Regardless of the type of burner you require — Pre-mix, Venturi, Gas-actuated fan, Center fire register, or Multi-jet—there is a John Zink Burner of the proper type and size to fill your requirements.

If you are using any of the above types of burners—John Zink can give you a more efficient and economical burner.

We are willing and capable of designing and manufacturing special burners for special purposes.

32 DIFFERENT TYPES

SERIES "V" BURNER
Pre-Mix Type—absolutely noiseless — especially good for boiler installation in churches, schools, and apartments.

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Refractory Type — especially good for installing in boilers having very low draft and small combustion space.

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Popular Zink Star Type—simple, sturdy, and efficient—especially good for installations in power boilers.

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Luminous Flame Type — fits 98% of all domestic furnaces—tested, approved, efficient and economical.

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ARMY

IF AN ARMY TRAVELS ON ITS STOMACH . . .

and it does, according to the Generals . . . it behooves us to take good care of that stomach. And since modern armies travel fast and far, that care is even more important.

Good food is absolutely essential to the creation of an effective armed force. Food must be stored efficiently, transported efficiently and served efficiently if the force is to function efficiently. The refrigeration industry, in doing this important task, is a vital factor in building our army and navy.

And this is important, too. Behind our armed forces is a far larger civilian army. An army just as vital to our war economy because it produces the money and munitions which are as necessary as man power. The refrigeration industry must CONTINUE to serve this civilian army . . . must draw upon its every resource to meet ALL essential needs, both military and civil. To this policy we are dedicated.

BUSH PRODUCTS ARE IN USE BY THE ARMY, NAVY, AIR FORCE AND MERCHANT MARINE TO MEET LITERALLY HUNDREDS OF COOLING AND AIR CONDITIONING REQUIREMENTS.

Bush Mfg. Co.

★ *Commercial Cooling Units* ★ ★

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ishes and telling how and where they are applied. The data are intended to aid manufacturers in figuring unit costs accurately and to establish the most efficient production schedule in keeping with their particular equipment.

Instruments

No. 4078—Meriam Co., 1955 W. 112th St., Cleveland, Ohio. 8 p. condensed catalog (C-10) on instruments for indicating pressure or flow of liquids and gases including U type manometers, draft gages, well type manometers, non-spill mercury pressure gages, flow meters and flow meter accessories and parts, and tank liquid level gages. Detailed information on the features of the instruments and list prices are included.

Lubrication

No. 4079—Texas Co., 135 E. 42nd St., New York, N. Y. Issue of Lubrication (Vol. 27, No. 11) devoted to the lubrication and maintenance of chain drives. Information is included on types of chains, factors governing chain lubrication, selection of lubricants and means of lubrication. Numerous photographs and diagrams are shown.

Memoirs

No. 4080—E. B. Badger & Sons Co., 75 Pitts St., Boston, Mass. An unusual booklet of 36 pp. beautifully

COCHRANE *Drainage Equipment for a wide range of Operating Conditions . . .*

PUBLICATION 2930
MULTIPORT DRAIN REGULATOR
Valve shuts off discharge when condensate falls to normal level. Tremendous discharge capacity

PUBLICATION 3025
COCHRANE-BECKER SYSTEM
of High Pressure Condensate Return

HEAVY DUTY BUCKET TRAP
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PUBLICATION 2925
MULTIPORT DRAINER
Rotating cylindrical multiport valve gives large discharge capacity

PUBLICATION 2935
HIGH PRESSURE DISCHARGER
For removing large quantities of condensate under high pressure

COCHRANE CORPORATION • 3131 N. 17th St., PHILADELPHIA, PA.

Cochrane

printed and with numerous interesting illustrations, marking the 100th anniversary of its publisher. Its contents comprise excerpts from the memoirs of Erastus Beethoven Badger. Of particular interest to those who have known Boston and have seen it grow.

Motors

No. 4081—Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo. 34 p. bulletin (MU-183) on single phase, direct current and small polyphase motors with detailed descriptions of the construction of repulsion start induction motors, repulsion induction motors, capacitor start motors, split phase motors, direct current motors, small polyphase motors, fan motors, and explosionproof motors. Detailed information is given on design and construction features and there are numerous illustrations.

Oil Fired Heaters

No. 4082—Despatch Oven Co., 600 Ninth St., S. E., Minneapolis, Minn. 4 p. bulletin (73) describing direct fired oil heaters with capacities up to 3,000,000 Btu per hr, with air delivery temperatures up to 1400 F. Features of the design are explained, typical applications are shown and a table of specifications is presented.

Patent Information

No. 4083—Allis-Chalmers Mfg. Co., Milwaukee, Wis. 54 p. booklet entitled Patent Background for Engineers,

PRIORITIES Can't Worry You

When You Re-Use Worn Thread Connections or Battered Gaskets

KEY-TITE Makes It Possible

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WATER PROOF
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... to re-use battered and worn connections of *all* types ... put them back into leak-proof service. Key-Tite should be used on all thread, flange, and gasket connections on lines to carry water, aqueous solutions, low-pressure steam, etc. It gives you an opportunity to complete work without delay while waiting for materials. And, you will be contributing definitely to the National Defense Program.

Key-Tite is economical to use ... it has far greater coverage than ordinary pipe-dopes. It will *not* settle in the can and will *not* freeze the joint in service ... it does not affect the color or taste of potable liquids.

LIBERAL FREE SAMPLE of Key-Tite can be obtained by writing or, order a supply from your distributor.

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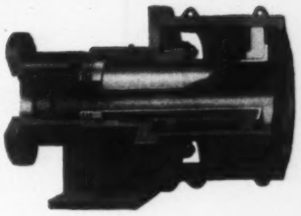
KEY COMPANY

AND WE CAN'T AFFORD TO SHUT DOWN OUR LINES
THEN INSTALL ADSCO PISTON RING JOINTS

Whether you are working on defense contracts or regular production, you cannot afford costly shutdowns in your service lines.



Install ADSCO Piston-Ring Expansion Joints—the slip type joints that can be unpacked and repacked under full operating conditions without interruption to service.

Get all the facts about this modern expansion joint that's always on the job . . . write for bulletin 35-15HP.

ADSCO PISTON-RING EXPANSION JOINT
for steam, hot water, oil or gas lines

Piston rings in internal guide hold line pressure during unpacking and repacking operations.

Fully guided by internal and external guide.

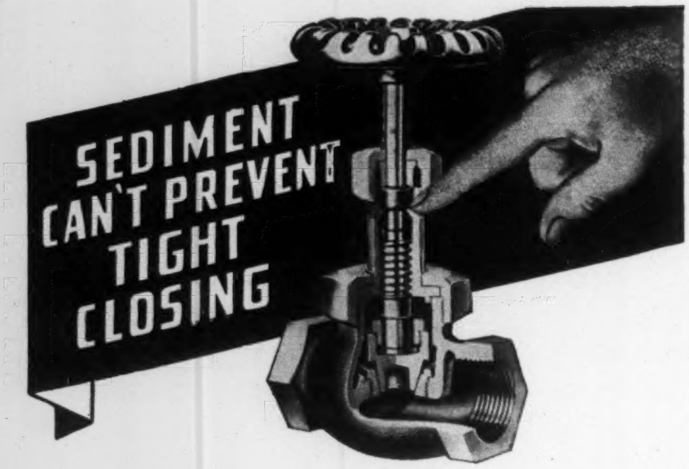
Available in single or double joints for high pressures and high temperatures; flanged or beveled ends.

AMERICAN DISTRICT STEAM COMPANY NORTH TONAWANDA, N. Y.

Making "UP-TO-DATE" Steam Line Equipment for Over 60 Years.

ADSCO PISTON RING JOINTS

Can Be Packed Under Pressure



Ever have trouble repacking the stuffing box of a valve because sediment had accumulated in the bonnet chamber? That can't happen with the *top* seat in Fairbanks Plug Valves. A tight seat is always certain because the shoulder on the stem which engages the seat in the bonnet is ABOVE the threads on the stem.

This tight closing feature makes it impossible for scalding steam or hot liquids to escape and burn your hands when repacking the stuffing box under pressure.

This method of top seating also eliminates the possibility of pitting or scoring which occurs when the seating surface is in the stream line.

Another outstanding feature of these valves is the wide sealing surface in the seat and disc and the angle of the plug. This construction distributes the stream flow so it is never concentrated in one position and gives protection against galling and wire drawing. These parts can be replaced easily and quickly, or reground, without removing the body from the pipe line.

Throughout, you'll find many other instances of the unusual care used in the design and manufacture of Fairbanks Plug Valves.

You can get Fairbanks Valves in bronze and iron for practically every condition. For name of our nearest distributor and Catalog No. 21, write THE FAIRBANKS COMPANY, 396 Lafayette St., New York, N. Y.

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Fairbanks
Standard and Renewable **Valves**

comprising a collection of articles originally appearing in the Electrical Review and designed to be of assistance to engineers and executives who deal with inventions. Written by patent attorneys and engineers for the lay mind, the articles deliberately avoid legal jargon and have been prepared in an entertaining style. Sections are included on the following subjects: patent quicksands; know your patents; patent fallacies; protecting new inventions; inventions for sale; who invented it; joint inventorship; patent interference; can you keep a secret?; public use in private, or vice versa; inventions "on sale"; trend of development in American patent law; what would compulsory patent licensing mean to you?; streamlining patent prosecution; and concerning trade marks.

Refractories

No. 4084—General Refractories Co., Broad and Chestnut Sts., Philadelphia, Pa. 72 p. catalog on refractories, presenting a most complete line of various refractory products available today with details on the various types presented in condensed form. Approximately half of the booklet is devoted to useful tables.

Refractories

No. 4085—North American Refractories Co., Cleveland, Ohio. 116 p book on Refractories—The Backbone of Industry, presenting a history of the industry, its beginning and growth, its development in processes and

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REZNOR Suspended Gas Unit Heaters

Here's the heater that has the widest range of industrial and defense applications. Reznor suspended heaters deliver heat directly to the spot you want it, and move more warm air over wider areas than any others. Since only a gas line and electricity are needed, installations are quick and easy. Not only fuel costs, due to intermittent firing, but also maintenance and installation expenses hit a new low. There's a Reznor representative near you. Write today for catalog U 42.

REZNOR MANUFACTURING CO.
305 James St., Mercer, Penna.

"GAS HEATERS EXCLUSIVELY SINCE 1888"

products, and containing suggestions for storing, handling and using of refractories for best results. John D. Ramsay is the author and the book is made up from the series of articles by him which appeared in Brick and Clay Record.

Steam Traps

No. 4086—Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa. 16 p. bulletin (T-1736) on "Yarway" impulse steam traps, giving complete information on construction features, operating principle, installation and operating suggestions, capacities, prices, weights and dimensions. There are also typical installations pictured and testimonials from users together with tables and other data on figuring sizes and diagrams showing various applications.

Unit Heaters

No. 4087—Reznor Mfg. Co., Mercer, Pa. Leaflet describing gas fired suspended unit heaters available in fan, blower and duct types.

Valves

No. 4088—Edward Valve & Mfg. Co., Inc., 1200 W. 145th St., East Chicago, Ind. 56 p. catalog (12-C) on cast steel valves, including complete design, dimensional and metallurgical descriptions of stop, check, and stop check valves. Stop valves are both globe and angle for pressures up to 2500 psi. Also described are hand-

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MAXIMUM EFFICIENCY
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Western's Wool Felt is specially designed to eliminate three difficult problems in air conditioning units:

(1) Condensation is eliminated on the outside and inside of the air ducts with a Western Wool Felt covering and lining.

(2) *Destructive vibration is eliminated* with Western Wool Felt.

(3) Equipment must operate quietly. Western Felt subdues noise of air passing through ducts, and when placed under motors, subdues motor noise.

These are vital factors in the successful operation of any air-conditioning unit.
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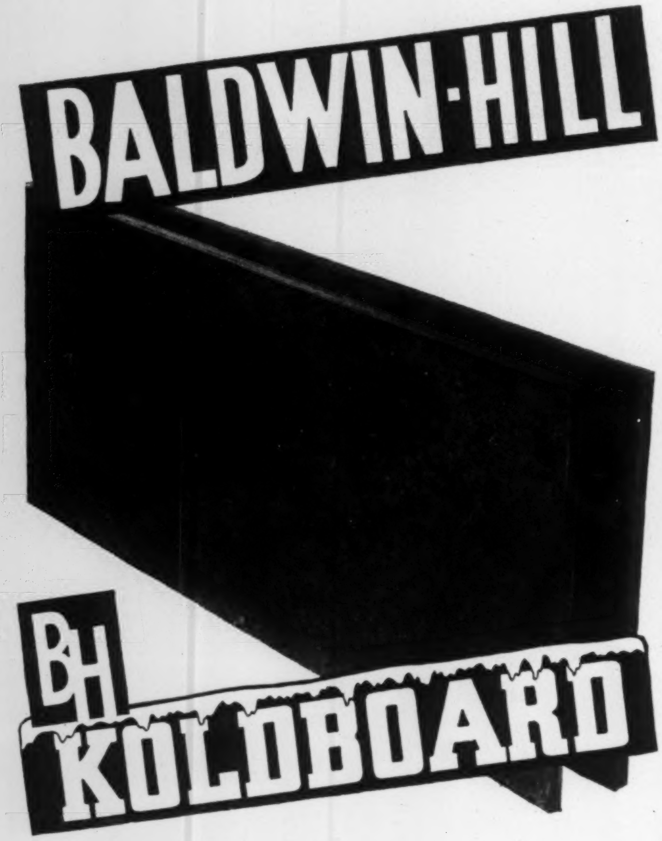

LOW TEMPERATURE INSULATION

B-H KOLDBOARD — with mineral base — answers the urgent demand for an economical, highly efficient refrigeration insulation. Highly resistant to moisture (0.68% moisture absorption at a relative humidity of 65% at a temperature of 75° F.) it eliminates the major cause of low temperature insulation failure, the infiltration of moisture. And it has a low thermal conductivity of only 0.32 B.t.u.'s. Write us for more complete information, heat loss chart, conductivity curve or call in a B-H engineer to advise on any specific application or insulation problem.

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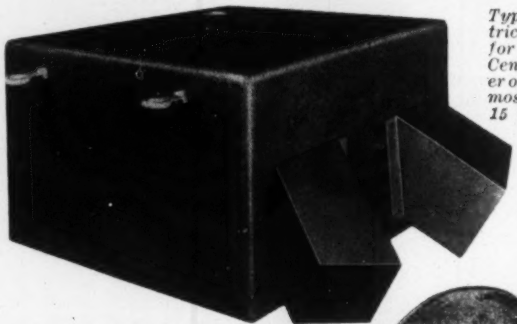
We also make a complete line of Heat Insulation Products
B-H MONO-BLOCK ... B-H No. 1 INSULATING CEMENT
B-H ROCKWOOL BLANKET...B-H No. 100 PIPE COVERING
B-H FELT INSULATION...B-H WEATHERSEAL AND OTHERS

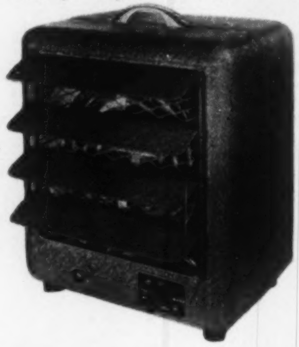
You can handle any air heating problem with a CHROMALOX

ELECTRIC UNIT HEATER



Type CUB electric unit heater for large areas. Centrifugal blower operated. Thermostatic control. 15 to 40 Kw.

Type UB for offices and smaller areas. Attractive crackle finish. Adjustable louvers to direct blower-driven air. Heating unit can be disconnected for summer cooling. Eight sizes to 15 Kw.



Type HF for individual rooms. New streamlined design, attractively enameled. Fan can be used without heater, for hot weather cooling. Four sizes—1½ to 4 Kw.

HEATING difficulties fade out of the picture when Chromalox Electric Unit Heaters come in. They eliminate long stretches of piping, heat losses, condensate problems, steam traps, valves, lagging. They provide additional heating capacity without increasing boiler load and permit overtime heating even when boiler fires are banked.

With Chromalox Unit Heaters you get speedy, simple installation anywhere a wire can reach—gate house, watchman's cabin, crane cab, wall or ceiling of shop or office. You get a column of *aimed* heat—accurately directed by adjustable louvers, setting up a refreshing circulation of warmed air. You get *quick* heat, controlled by the snap of a switch, either manual or automatic.

Operating cost?—probably less than you think. You can check on it easily enough. Your power company will help—so will our electric heating experts. Just say the word.

Heaters from 1.5-Kw. to 40-Kw. Types for all needs. The Chromalox Book of Electric Heat—on request—gives all the facts.

EDWIN L. WIEGAND CO.

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CHROMALOX
Electric Heat for Industry

wheels, throttlers, bypasses, etc. There is a section on pressure-temperature adjusted service ratings, flange facing information and drawings and helpful tips on valve usage.

Valves

No. 4089—Edward Valve & Mfg. Co., Inc., 1200 W. 145th St., East Chicago, Ind. 4 p. catalog (12-G5) announcing the new "Intex" hard surfaced integral seat globe stop valves for pressures up to 2500 psi at 950 F. These valves have been designed particularly for high pressure and high temperature service and incorporate many unique design features. They are available in ½ in. to 2 in. sizes in socket welding, flanged or screwed ends.

Vibration Isolation

No. 4090—Korfund Co., Inc. 48-15 32nd Pl., Long Island City, N. Y. 8 p. bulletin (Ba-32) entitled Extra Machine Hours showing prominent installations of the manufacturer's "Type S Vibro-Isolators," covering a wide range of marine and stationary applications showing diesel engines and general industrial machinery. A chart showing the rated capacities of these devices is included.

Water Heaters

No. 4091—Whitehead Metal Products Co., Inc., 303 W. 10th St., New York, N. Y. First issue of a new publication titled the Whitehead Wave, in tabloid newspaper rotogravure style, with various tips and timely suggestions pertaining to water heater tanks. A story on savings by means of proper installation is featured, as are various defense applications.

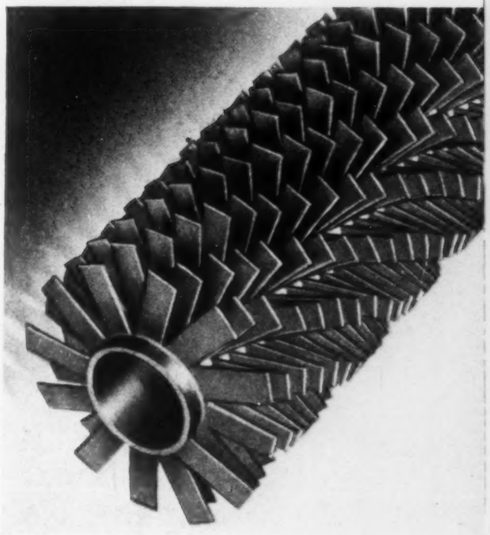
Water Treatment

No. 4092—American K.A.T. Corp., 122 E. 42nd St., New York, N. Y. First two issues of a new series of informative bulletins on latest developments and current results being obtained in the treatment of water for boilers, stills and evaporators. This bulletin carries concise technical explanations of various methods of water treatment, with special reference to the use of all-organic colloidals. There are also short news items describing how plants in various industries have solved their water treatment problems, and notes on securing best results in the operation of boilers, stills and evaporators.

Welding

No. 4093—Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y. 54 p. booklet entitled A Quarter Century of Progress, giving a detailed description of the activities of the five companies which comprise Air Reduction Co., Inc. A particularly interesting feature is a large chart in color showing the numerous uses of the company's products, including various gases and arc welding and gas welding equipment.

TILCO-FIN



"dual efficiency"

● HIGH HEAT TRANSFER
● LOW RESISTANCE

THE EXTENDED SURFACE TUBING WITH DUAL EFFICIENCY—HIGH HEAT TRANSFER AND REMARKABLY LOW RESISTANCE ARE CHARACTERISTIC OF ALL SIZES AND TYPES OF TILCO-FIN TUBING. ***Recognition is now being given the fact that the design of a surface greatly affects its performance. Constantly increased attention is being focused on the performance of extended surface tubes by engineers and designers. No longer will just any surface stuck on a tube answer the demand for maximum efficiency.

***TILCO-FIN stands at the top of the list in efficient fin design. Recent research has shown that the best designed surface is as much as three times more efficient.

***TILCO-FIN high performance surface becomes an integral part of the tube on which it is placed. Excellent design, sound manufacturing methods and good workmanship combine to make TILCO-FIN a tube that meets the demand for superior all round performance.

***When thinking of critical metals and how to get the most out of every pound of material used, bear these two facts in mind;

1. TILCO-FIN has the highest performance ratio per square foot of surface.
2. Steel fins can be substituted for the regular copper surface without greatly impairing the performance characteristics of the tube.

TILCO-FIN INC.
● 58 SECOND AVE. BROOKLYN, N. Y.

Industry Saves Money on

PLANT HEATING

★Large Industries Make Drastic Savings With *Gas-Fired* UNIT HEATERS

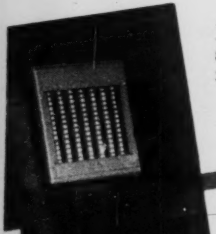
Janitrol unit heaters do more than give excellent heating results . . . do more than provide those results automatically . . . do more than conserve space. In addition to many such operating advantages, they show remarkable dollar and cents savings . . . many of America's outstanding industrial firms attest to that fact.

★ **LIBBEY·OWENS·FORD** show 54% fuel saving with 121 Janitrol unit heaters at their Charleston plant.

★ **LAKEY FOUNDRY & MACHINE COMPANY** save $15,000 on annual heating costs with their 48 Janitrol unit heaters.

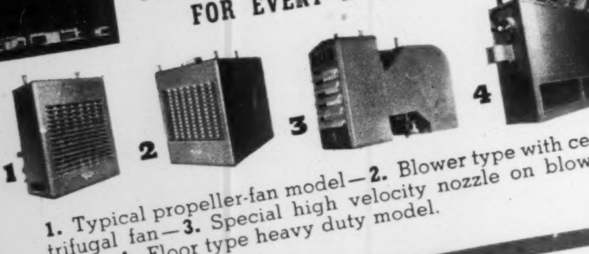
★ **G & G MANUFACTURING COMPANY** use 38 Janitrols, saving yearly wages of two firemen plus 16% saving in fuel bill.

★ **HAUGHTON ELEVATOR'S** 41 Janitrol unit heaters save 53% over previous heating costs . . . and $15,000 in first investment.



Janitrol unit heaters are made in both ceiling suspended and floor mounted types. Capacities range from 60,000 to 1,250,000 Btu input.

THERE'S A TYPE AND SIZE JANITROL FOR EVERY INDUSTRIAL NEED



1. Typical propeller-fan model—2. Blower type with centrifugal fan—3. Special high velocity nozzle on blower type—4. Floor type heavy duty model.

JANITROL SC

GAS-FIRED UNIT HEATERS

SURFACE COMBUSTION CORPORATION · TOLEDO, OHIO

Useful Information

Solid Fuel Coordination

The framework of the organization to carry out President Roosevelt's request for Secretary of the Interior Harold L. Ickes to coordinate the nation's supply of solid fuels, vital to prosecution of the war, has been completed, Secretary Ickes announced December 31. The four top officers selected will serve with Howard A. Gray, the new acting director of solid fuels coordination, to aid Secretary Ickes in carrying out the instruction that adequate steps be taken to assure that supplies of bituminous coal, anthracite and coke will be sufficient to carry out the expanded war program and civilian needs. Formation of the nucleus of the coordinator's staff was preceded by Secretary Ickes' organization of producers, transporters and dealers in bituminous coal, anthracite and coke on a wartime footing.

Defend the Defense Worker

Practical measures for health protection of workers, prime requisite for maximum production, were outlined for industry at the sixth annual meeting of the Industrial Hygiene Foundation held recently at Mellon Institute, Pittsburgh, Pa. Approximately 400 industrial executives and employee health specialists attended, a gain of 170 over last year. Theme of the meeting was "defend the defense worker."

Delegates heard results of foundation supported researches, including effects of arc welding fumes on tuberculosis and best x ray techniques for mass physical examinations. Authorities urged employers to conduct industrial hygiene surveys and to keep records of sick absenteeism—fundamental steps in the conservation of industrial manpower, especially now when increasing production tends to increase health hazards.

Dr. W. M. Gafafer, senior statistician, U. S. Public Health Service, reported first returns from a study to help reduce sick absences in industry which the foundation is conducting in collaboration with the Public Health Service. Dr. Gafafer found that sick absenteeism rates of foundation companies participating in the "audit" varied from 1.69 to 3.39 days per male per year for absences of eight days or longer. Meanwhile, including all absences, regardless of duration, the total was estimated at twice the above figures.

Exhaust Ventilation

H. B. Meller, managing director of the foundation, reported that in helping keep precaution in step with production, the foundation's staff hygienists covered more than 25,000 miles during the past year and operated in seven states. A dozen surveys were made in seven different industries, involving approximately 100,000 workers. He said that a new membership service was developed during the past year — consultation on exhaust ventilation systems. This became possible through an engineering survey which the foundation is supporting at the University of Pennsylvania. Companies planning to install exhaust systems should first submit their plans to the foundation for a double check, he advised.

Welding Fumes

Dr. L. U. Gardner, director, Saranac (N. Y.) laboratory, reported the following findings from the foundation supported study of the effects of arc welding fumes on susceptibility to tuberculosis: "The results thus far observed constitute evidence for the view that severe inflammation of the lungs does not necessarily influence the course of a tuberculous infection. They also indicate that exposure to even excessive concentrations of arc welding fumes is unlikely to have a bad effect upon either fresh or old tuberculous (foci) in a worker's lungs." Dr. Gardner further reported that there has been an even greater decrease in the tuberculosis mortality in industrial groups than in the population at large. A low standard of living rather than specific environmental factors is responsible for most of the tuberculosis among wage earners.

Dr. D. W. Crombie and Dr. J. L. Blaisdell, Queen Alexandra sanatorium, Ontario, Canada, reported on the present status of their experimental work on the use of aluminum powder as a possible preventive for silicosis. They warned industry that their work, while hopeful, is still far from complete and that no practical applications of this technique may be considered at this time.

Sabotage Precautions

Edward A. Tamm, assistant director of the Federal Bureau of Investigation, discussing the protection of men and machines, reported findings from surveys of 2022 plants by special agents as a precaution against sabotage and other subversive activities. "Deficiencies most frequently found," Mr. Tamm disclosed, "pertain to the matter of selecting and investigating personnel, identification of employees, guard protection, exterior and interior illumination, fire fighting equipment, handling of visitors, fencing of property, screening of windows, and protection of confidential blueprints and records."

Industrial Hygiene at Work

Warren A. Cook, past president of the American Industrial Hygiene Association, spoke on industrial hygiene at work in the defense industries. Modern industrial hygiene methods are accomplishing much in avoiding occupational diseases among workers and in raising the general health levels through provision of favorable occupational environments, he said.

One example he gave involved the manufacture of bulletproof gasoline tanks for airplanes. Benzol is used in the neoprene cements used to make up the alternate layers of leather and sponge rubber, and is also used to prepare the surfaces to be cemented. All of the benzol used evaporates into the workroom atmosphere. In one such workroom, 140 men were at work, 40 of whom were actually using the benzol. The management became suspicious that this solvent was making the men sick.

A survey of operating conditions by trained industrial hygienists showed that exposures to the benzol were excessive. Blood examinations indicated that 19 of the men were sufficiently affected to require immediate transfer to operations not involving benzol. The hazard was materially reduced by substituting a less toxic solvent and, for the operations where it was preferable to continue the use of benzol due to its superior solvent prop-

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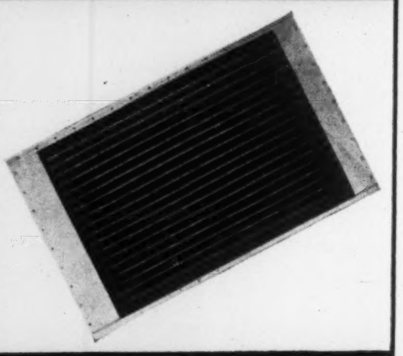

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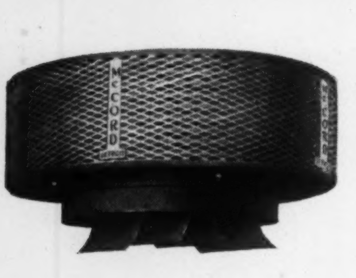

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erties, exhaust ventilation was designed. In fact several alternative designs were sketched and presented to the engineering staff of the concern for their consideration. The optimum ventilation system for the purpose was thus developed.

Ventilation in Magnesium Foundries

Illustrative of another hygiene situation is the rapidly expanding magnesium foundry industry, he stated. Magnesium foundry practice has been developed principally by a large concern which has a keen appreciation of the necessity of control of potential health hazards, maintains an able staff for this purpose and has potential health hazards under observation. Consequently no appreciable injury from a number of these special hazards which this industry introduces is anticipated. The advantages of giving proper attention to them before rather than after a group of cases of injury to health have occurred are evident.

As is well known, magnesium burns very easily. In order to control combustion when the molten metal is poured into the mold, sulphur is added both to the molding sand and to the cores and, in addition, is sprinkled on top of the molten metal in the ladle. The sulphur is oxidized to the extremely irritating gas, sulphur dioxide, which rises from the operation due to convection currents even though this gas is itself just twice as heavy as air. In foundries constructed for the purpose, general ventilation is probably sufficient to keep sulphur dioxide exposures within limits which will not cause excessive irritation to the upper respiratory tracts. However, in older foundries which may be adapted to the production of magnesium castings—and there are at least a score of foundries casting magnesium throughout the country—

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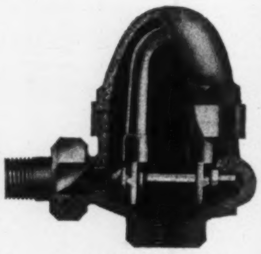

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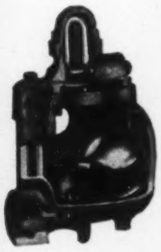

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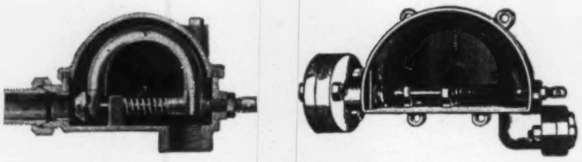

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it is possible that adequate provision may not be made for the removal of sulphur dioxide. Unless recognition is taken of the need for adequate ventilation, not only for the protection of the men in the area where pouring is being conducted but also for the protection of those who may be in the path of the gas as it rises to the ceiling with hot air currents, cools off and then drops due to its higher specific gravity to expose men some distance away, a chronic irritation of the throat may develop among the group of workers.

Solvent Vapor Exposure

Solvent vapor exposure is not ordinarily contemplated in connection with foundry operations but where thin sections require smooth finishes, as in airplane engine cylinder block castings, carbon tetrachloride has been used in connection with resin core washes. Here it is necessary to guard not only against the exposure to the carbon tetrachloride vapor itself but also to make sure that there is no possibility of exposure to phosgene into which the carbon tetrachloride is hydrolized if this vapor comes in contact with incandescent surfaces in core ovens or from molten metal or freshly poured castings. Phosgene has its purposes as a war gas but it has no place in the foundry.

In testing the sulphur content of the sand in the magnesium foundry, the reagent, carbon disulphide, is employed. It is probable that sufficiently small amounts of this solvent are used that exposures would not normally reach injurious amounts but where such tests may be made in small unventilated rooms, careless handling of carbon disulphide may permit concentrations of the highly poisonous vapor to reach injurious limits. In fact if more than 3/100 of an ounce of carbon disulphide is

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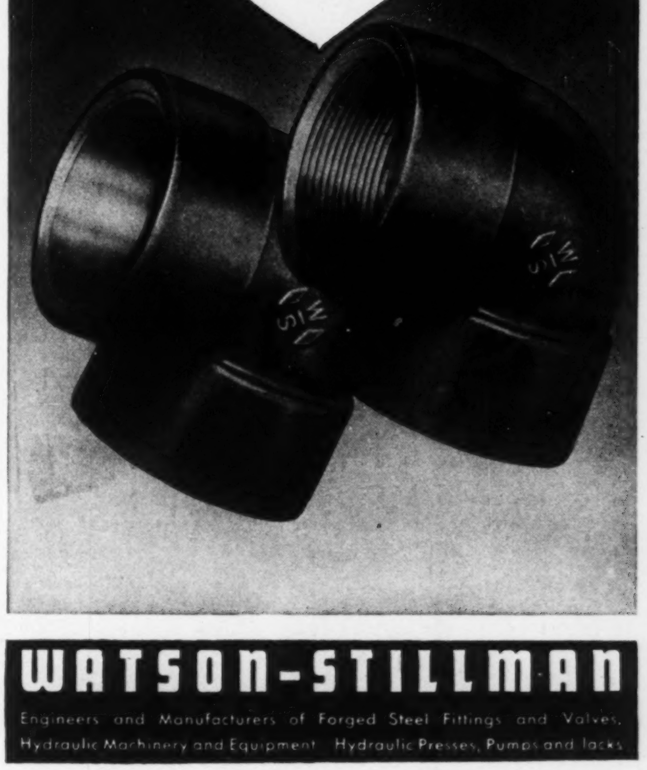

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spilled and completely vaporized in a room of 1000 cu ft, the safe concentration for this vapor will be exceeded, Mr. Cook said.

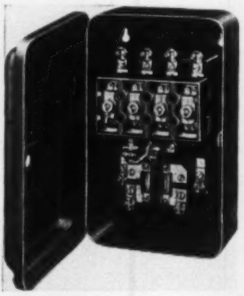
Painting Luminous Dials

Special requirements of national defense have stimulated the use of radioactive lacquers for painting luminous dials for instrument boards and other devices which must be seen in the dark. The type of problem which requires the combined resources of the engineer and the chemist is well illustrated in the safeguarding of this operation, according to Mr. Cook.

In one installation exhaust hoods had been provided but the exhaust ventilation had been reduced by means of blast gates to such an extent that the exposure approached the suggested limits. It was found that air velocities at the face of these hoods was as low as 10 fpm at the end of the line; that is, a barely perceptible air movement. On the suggestion that the velocity be increased, objection was raised that this would cause the luminous paint to dry out too rapidly and so spoil the work. From the chemical point of view the situation was then taken care of by the suggestion that a series of less volatile solvents and plasticizers be used in the luminous paint which would give the same drying properties with the increase in ventilation.

Flow of a Flashing Mixture of Water and Steam Through Pipes

A paper on the flow of a flashing mixture of water and steam through pipes was presented at the annual meeting of the American Society of Mechanical Engineers last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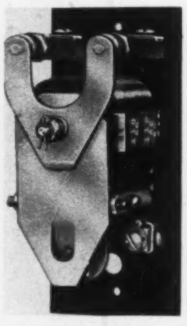
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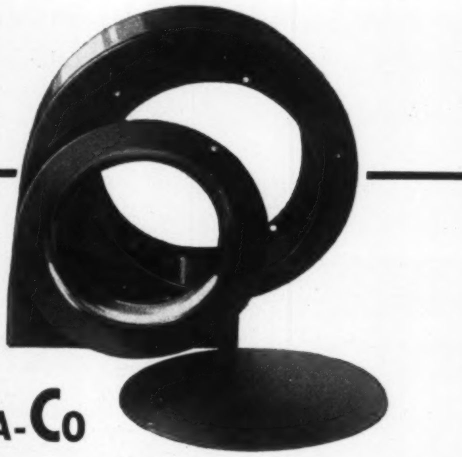
month by M. W. Benjamin and J. G. Miller of the engineering division of The Detroit Edison Co. The paper gives a method of designing piping for this purpose; an example of such piping is the cascade drain lines between feedwater heaters.

The flow formula given in the paper is based on a thermodynamic analysis of the problem, and the necessary coefficients of friction were determined from tests.

The paper also includes a discussion of erosion of elbows in pipe lines carrying a flashing mixture, and suggests designs for minimizing or preventing failures from this cause. A criterion for predicting the comparative life of different sizes of pipes for a given line carrying a flashing mixture is set up on the basis of the total force on the elbows due to the momentum of the flowing fluid.

For practical purposes a flashing mixture of water and steam flowing through a pipe can be treated as an elastic fluid, Messrs. Benjamin and Miller conclude. The results of tests show that a critical pressure condition can exist in the end of a pipe carrying a mixture of water and steam, which is similar to the critical pressure condition that will exist in a line carrying steam (or any other elastic fluid), in which the pressure drop in the pipe is sufficient to produce an acoustic velocity. Whether or not the velocity of a mixture flowing through a pipe having a critical pressure condition is the acoustic velocity is a question that cannot be answered until more is known about the velocity of sound through a mixture of a liquid and vapor. The existence of a critical pressure condition in a pipe carrying a mixture of water and steam depends upon the combination of the following factors: (a) The initial saturation temperature of the



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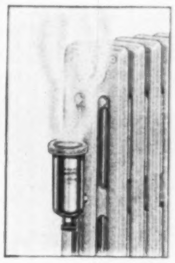

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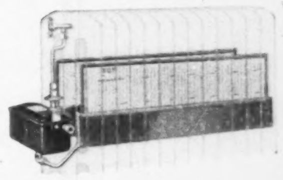

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Evaporates up to 1½ gallons of water per day with a radiator temperature of 130°. Reasonably priced. Full automatic in operation, requiring no attention after installation. Takes its water supply from the radiator, which is vented at the same time. Can be used with steam radiators from separate water supply. Made in three lengths: 18, 24 and 34 inches. Easily and quickly installed.

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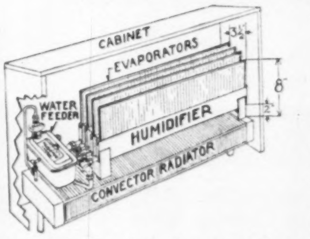

This high efficiency humidifier operates on exactly the same principle as the OL' FAITHFUL. The radiator cabinet completely conceals the humidifier. It provides adequate humidification without requiring the slightest attention. Made with 2 or 4 troughs, in lengths from 22" to 39", and furnished with the troughs assembled for easy installation.

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For Hot or Cold Circulating Pipe Lines

The No. 7 Auto-Vent Air Eliminator will completely vent air from hot or cold circulating lines, concealed radiators, unit heaters, tanks. Diesel engines, cooling manifolds, etc., and keep the liquid flowing. For pressures up 75 lbs. The unit is simply constructed, is positive in action, will act indefinitely.

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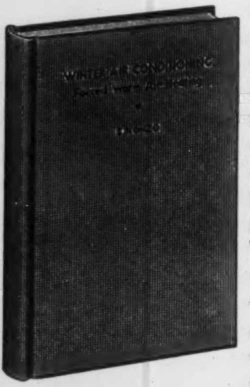
University of Illinois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Now available in this big 532-page book is the complete record of the results of the exhaustive studies of forced warm air heating carried out over a period of several years at the University of Illinois Research Residence. This newly published volume, WINTER AIR CONDITIONING embodies ALL of the vast fund of practical knowledge which has come out of the investigations. It is filled with basic information that heating men everywhere will find invaluable as a guide to correct and up-to-date practice in the design and installation of forced air heating and residential air conditioning systems.

The author, S. Konzo, actually lived in the Research Residence during the entire period of the studies, and himself conducted or had a hand in every one of the innumerable tests that were made on the Residence forced air system. Konzo was chosen to organize and analyze the test findings for the industry in permanent book form not only because of his first hand knowledge of the test results, but also because of his ability to write clearly and concisely. In WINTER AIR CONDITIONING he has turned out a volume that will, without question, quickly become, and for years remain, the "bible" of the forced warm air heating industry.

WINTER AIR CONDITIONING belongs in the hands of every one interested in forced air heating or residential air conditioning. As this book has been published by the National Warm Air Heating and Air Conditioning Association primarily to make its invaluable data readily available to all, it is offered to the industry at the low, non-profit price of only $3.00 per copy. To obtain a copy promptly send your order and remittance today to the address below.

Those who are interested also in the Association's previous book, "Gravity Warm Air Heating, Digest of Research," which is also priced at $3.00, may obtain this book and WINTER AIR CONDITIONING together at the reduced combination rate of only $5.00.

KEENEY PUBLISHING COMPANY
6 N. Michigan Ave., Chicago, Ill.

water leaving the high pressure receiver; (b) the quantity flowing; (c) the size and length of the pipe; (d) the pressure of the receiver into which the pipe discharges.

While the data presented in the paper concern only the flow of a flashing mixture of water and steam, it seems probable that the analysis given would be applicable to the flow of any flashing mixture of a liquid and its vapor, the authors state. For the latter, however, it might be necessary to determine new values for the friction coefficient.

Graphical Solution of Fluid Flow Problems

E. S. Dennison, engineer in charge of development, Electric Boat Co., presented a graphical solution of fluid flow problems in a paper before the annual meeting of the American Society of Mechanical Engineers, held in New York last month.

It is customary to present fluid friction data in the form of a diagram to log scale in which friction coefficient appears as a function of Reynolds number. Such data are widely applicable to physical circumstances other than those which pertained to the original experiments.

Mr. Dennison's paper describes a graphical procedure for utilizing data of this character, where analytical methods are not practicable, and resort is made to trial-and-error methods. Similar methods to that described may be found useful in other fields than that of fluid friction, provided the experimental data are capable of being represented in nondimensional form.

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Coming Events

American Society of Heating and Ventilating Engineers: Annual meeting, January 26-30, Philadelphia, Pa. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y. For complete information, see article starting on p. 41 of main editorial section.

Seventh International Heating and Ventilating Exposition: January 26-30, Commercial Museum, Philadelphia, Pa. Under auspices American Society of Heating and Ventilating Engineers and under management International Exposition Co., Charles F. Roth, president, Grand Central Palace, New York, N. Y. For complete information, see article starting on p. 41 of main editorial section.

Heating, Piping and Air Conditioning Contractors National Association: 53rd annual convention, May 25-28, Hotel Schroeder, Milwaukee, Wis. George J. Stoehr is chairman of the local convention committee. Headquarters office, 1250 Sixth Ave., New York, N. Y.

Book Reviews

Thermochemical Calculations

Reviewed by W. R. Marshall, Jr.

Thermochemical Calculations, a new book by Ralph R. Wenner, published by McGraw-Hill Book Co., Inc.,

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Now, at the beginning of a new year in which the conservation of metals will be of the utmost importance for National Defense, we repeat something that we have been saying for many years: **Dart Unions pay greater dividends on your investment because they can be re-installed again, again and again.**

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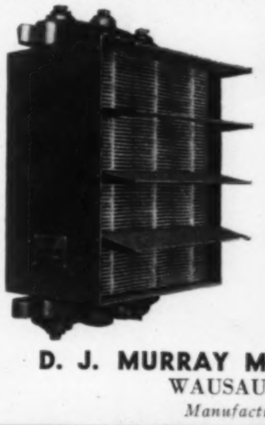

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The book consists of two parts. The first deals with fundamentals and principles, and consists of eight chapters. The first six of these include the usual standard thermodynamic concepts involved in the calculation of thermal effects of chemical, physical, and solution processes, and in the calculation of chemical and physical equilibria. Chapters 7 and 8 represent the most important contributions of the book. Chapter 7 on the partition function and all the many developments therefrom is probably the best chapter in the text and has been handled in a way which makes it easily understandable. Chapter 8 presents a splendid summary of the entropies of organic compounds.

Part 2, consisting of nine chapters, illustrates applications of the principles to so-called industrial processes. Chapter 9, the first of this section, deals with the methods of analytical chemistry, but seems to have little bearing on industrial problems. Chapter 10 illustrates "the use of the thermochemical data in the development of

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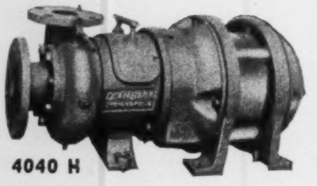

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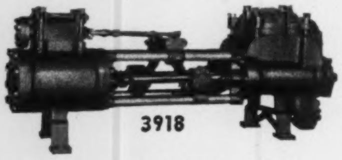

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Durable Duplex, Packed Piston Pattern Steam Pump

Centrifugal Pumps Turbine and Motor Drive Pumps for Handling Most Any Liquids and Service Steam and Power Driven

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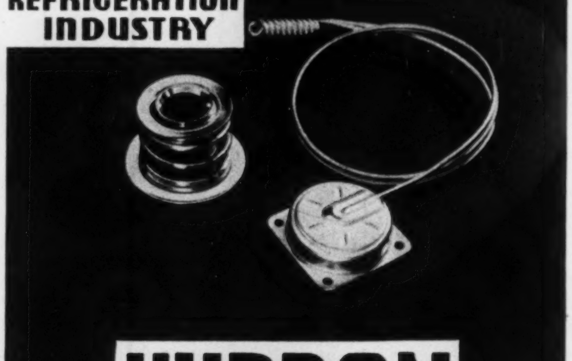

HYDRON
METALLIC BELLOWS
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chemical processes and as a guide in plant operations." Chapter 12, which considers the design of converters, is good but it is limited in its treatment. Chapter 13 on gas absorption, although seemingly out of place in this text, has merit. It illustrates a problem involving chemical reaction concomitant with absorption.

A short chapter on air conditioning offers a single illustration of the design of a water cooling tower. The procedure illustrated is the usual one of integrating three simultaneous differential equations to determine the height of a tower to effect a desired degree of cooling.

Chapter 15 on metallurgical applications is excellent and offers several new types of problems.

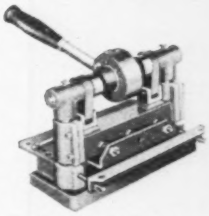
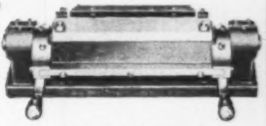
The last two chapters on the liquefaction of gases and fluid flow seem to have no relation to thermochemistry.

Price of this 384 p. book is $4.

Temperature Measurement

Temperature Measurement and Control, by Robert L. Weber (published by the Blakiston Co., Philadelphia, Pa., price $4), is intended primarily as a text book, but nevertheless contains considerable information of value to those who make use of temperature measurements. The book starts with the fundamentals of the various types of temperature measurements, and then carries through to the application of each method in practical engineering work. Some knowledge of mathematics is required in order to follow the development of the elementary principles. However, the practical application of the various thermometric methods can be grasped even with only an elementary knowledge of algebra.

The book is divided into two parts, the first of which

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Samuel R. Lewis'
"AIR
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Third Edition
288 Pages—Illustrated
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Here is a book that presents—in simple, readily understandable form—every kind of information necessary for an accurate and thorough knowledge of air conditioning principles, equipment, and practices. Written by S. R. Lewis, a widely-known consulting engineer who has been active in air conditioning work for more than thirty years, it deals with all angles of the air conditioning subject from the practicing engineer's viewpoint. The designing procedures explained in the book are, for example, in every detail the same procedures employed today by the author's own organization.

Featuring this third edition are several entirely new chapters on phases of the subject not previously treated, including noise control, air conditioning measurements, air conditioning standards, fire protection codes and operating suggestions. Brand new designing examples are also used, together with new forms for recording the design data, the proper filling-in of which is explained step-by-step.

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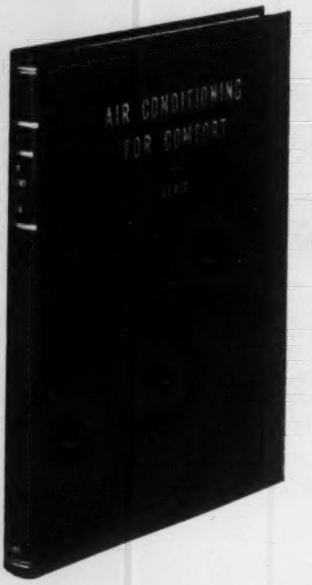

covers the principles utilized in temperature measurement. Excellent chapters in this part cover measurement by means of mercury thermometers, thermocouples, resistance thermometers and high temperature measurements by means of radiation pyrometry. Excellent chapters are also included on heat transfer in relation to temperature measurements, and the application of elementary thermodynamics to fundamental temperature scales. Included also are descriptive chapters on recording thermometers and automatic temperature control. All in all, this first part of the book should be of considerable value to those who deal with temperature measurements.

Although the second part of the book deals with experiments and is of primary interest to students, nevertheless the reader who carefully studies this portion of the book will be well repaid.

The appendix contains numerous tables and data useful in thermocouple measurements.

ASTM Supplement Books

To keep up to date its triennially published book of standards, the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., in the two intervening years issues supplements to each part of the book. The 1941 supplement, which will be the last one issued (in 1942 a complete new book of standards will be prepared) has been published as of December, 1941, and gives in their latest approved form the 370 specifications, tests and definitions, either issued for the first time in 1941 or revised.

Part 1 on metals, with 126 standards, covers some 619 pp. including 42 specifications covering ferrous metals—iron castings, steel, etc.; 82 specifications pertaining to the non-ferrous field—aluminum and aluminum alloys, magnesium and magnesium alloys, copper and copper alloy castings, and lead and lead alloys; and two general testing methods.

Part 2 includes 125 standards and comprises 449 pp. covering nonmetallic materials used for constructional purposes.

Part 3, 663 pp., covers coal and coke, petroleum products and lubricants, electrical insulating materials, plastics, rubber products, textile materials, paper, etc.

Copies of the supplement, each of which includes correction stickers for affixing in the previous books, can be obtained from the ASTM headquarters, at $3 for any one part, $5 for any two parts, and $7 for all three parts.

ASTM Standards Index

The American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., has just published a new index to ASTM standards, including tentative standards, as of December, 1941. This publication is essential in using the ASTM book of standards and its two supplements for 1940 and 1941, and it is also of particular service to those who wish to determine whether ASTM has issued standard specifications, test methods or definitions covering a particular engineering material or subject. A list is given of the 1043 specifications and tests in numeric sequence of their serial designations.

Copies of the 196 p. publication are furnished without charge on written request to ASTM headquarters.

THE EDITOR'S PAGES

BUILD COAL STORAGE PILES, SAYS ICKES

Secretary of the Interior Harold L. Ickes last month warned industries that depend upon coal and coke for fuel and raw materials that to protect their fuel supply they must act to build up storage piles while surplus mine and transportation facilities are available, in view of the tremendous war program now gathering momentum. He said the war plan laid down in President Roosevelt's message to Congress voids all previous yardsticks by which fuel needs and the sufficiency of fuel production and transportation facilities might be measured.

Secretary Ickes urged all users of anthracite, bituminous and coke—both industrial and domestic—to take advantage of the surplus mine and transportation capacity which will be available for a short while longer to build up their stock piles to the limit, and then do everything they can to keep them there. Coal in your bin, during times like these, he said, is the best possible protection against shortages. He said this would help the war program and not be detrimental hoarding.

COMMEMORATES FIRST FIFTY YEARS

Back in 1891 the population of the U. S. A. was 63,000,000, "After the Ball" and "Sidewalks of New York" were popular songs, telephones hung from the wall in the parlor—and the vapor disc room thermostat was a diminutive instrument 15 inches in diameter. Progress since those days, particularly in the field of the all pneumatic system of temperature control, has been outlined in a book commemorating "Our First Fifty Years", published by the Powers Regulator Co., incorporated June 15, 1891. Unfortunately—for it is a most interesting story—the book was printed only for members of the Powers organization.

According to the book, the first individual room thermostat installation was made by the company in 1893 in the First Congregational church, Nashau, N. H. Early comfort air conditioning installations regulated by Powers control included the Gold room (1907) of the Congress hotel, Chicago, and the Pompeian room (1909).

CONCENTRATES ON WAR AIR CONDITIONING

Carrier Corp. announced last month, through a resolution passed by its board of directors, that its entire productive capacity will be concentrated on war essentials, and that "civilian requirements will be met only when excess capacity is clearly available."

In making public the resolution of the board, J. I. Lyle, president, pointed out that nearly 60 per cent of the corporation's production is now going to war work, mostly air conditioning and refrigerating equipment in which it has pioneered for years.

One of the uses of air conditioning equipment most important to the war effort is in helping the steel industry to increase production through air conditioning blast furnaces. Other war industries use air conditioning to provide temperature and humidity control necessary in scores of processes in the manufacture of metals, plastics, chemicals, synthetic textiles and rubber, precision instruments and the like.

Air conditioning also makes possible the construction of windowless blackout factories, and underground bombproof shelters.

HOLDS OPEN HOUSE IN NEW FACTORY

E. J. Gossett, R. E. Moore and C. E. Pullum played host January 10 to over 1000 guests at the recently completed Bell & Gossett factory at Morton Grove, Ill. The 70,000 sq ft area of the plant is now in full operation, turning out forced hot water heating systems, water heaters, and heat transfer equipment. One of the high spots of interest was the "Monoflo" fitting machine, shown in operation.

The heating of this new plant was described on p. 576 of the September, 1941, HPAC.

STOKER SALES DIP SLIGHTLY

Factory sales of all sizes and types of mechanical stokers reported for November, 1941, amounted to 10,877 as reported by 80 of the 101 manufacturers on the list to the Bureau of the Census, Department of Commerce, according to the Committee of Ten, Coal and Heating Industries. This is a decrease of but 1.27 per cent compared with November, 1940.

Sales of all sizes and types of stokers for the first eleven months of 1941 total 183,796, compared with 146,243 in the corresponding period of 1940.

TIMMIS ASKS MANUFACTURERS TO RUSH PRIORITY FORM PD-25A

The government has recognized that repair and maintenance of heating and plumbing are essential. In the production requirements plan (for manufacturers) and in suppliers' order M-67 (for wholesalers and dealers) a scheme has been devised for the production and equitable distribution of heating and plumbing supplies to be used for the repair and maintenance of retail stores, commercial concerns, homes and farms.

While the production requirements plan and order M-67 may be supplemented by other measures, they now constitute an informal repair and maintenance plan for heating and plumbing, according to W. Walter Timmis, chief of the plumbing and heating branch of the War Production Board.

M-67—an inventory control measure—depends for its success upon the prompt and full cooperation of manufacturers in the production requirements plan. Manufacturers should fill out and submit *without delay* their copies of PD-25A, says Mr. Timmis. The ability of wholesalers and dealers to obtain inventories of repair and maintenance items hinges upon the quick response of manufacturers to their request. The work of the plumbing and heating branch will be hampered if the quick and wholehearted cooperation of manufacturers is not received.

THE EDITOR'S PAGES

Continued

DEFENSE HOUSING PRIORITIES PROCEDURE REVISED

Manufacturers supplying building materials for defense housing projects should hereafter apply for priority assistance under the recently announced production requirements plan. This plan is a simplified scheme under which approved production may be granted priority ratings which will assist a producer in obtaining required materials for three months at a time.

This change in the procedure on defense housing projects is provided for in connection with an amendment to preference rating order P-55, issued last month.

ARC WELDING FILM IN COLOR TO SPEED DEFENSE TRAINING

An all-color training picture, Inside of Arc Welding, now ready for release to schools and training groups and produced by Raphael G. Wolff, is designed to speed up the training of the thousands of apprentice welders required for the building of ships, planes, tanks and other armaments. It illustrates the techniques of arc control and electrode manipulation, and actually shows what goes on inside the electric arc.

Filming of this subject was accomplished with great difficulty by the application of new lighting methods which permitted the camera to pick up the entire welding process.

The picture consists partly of animated cartoons and partly of the actual welding shots. It features also the antics of "Joe McGee, the Welder."

Anyone interested can obtain complete information on cost and method of distribution by writing Raphael G. Wolff Studios, 1714 North Wilton Pl., Hollywood, Calif.

PRIORITY ASSISTANCE FOR SCHOOLS AND COLLEGES

Douglas C. MacKeachie, director of the division of purchases of WPB, has announced the addition of a schools section to the governmental requirements branch and the appointment of George Frank, purchasing agent of Cornell university, as chief of that section.

Applications of schools and colleges, public and private, for priority assistance in obtaining critical materials, including steel and copper for new buildings and additions, will be handled by Mr. Frank.

NEW BOARD CHAIRMAN AND PRESIDENT

At a meeting of the board of directors of Allis-Chalmers Mfg. Co. last month, Max W. Babb, president of the company, was elected chairman of the board of directors, and W. C. Buchanan, a director and member of the executive committee, was elected to succeed him as company president.

Mr. Buchanan has for the past six years devoted a substantial portion of his time to the Globe Steel Tubes Co., of which he is president, and in which capacity he will continue.

Mr. Babb, in becoming chairman of the board, will fill the position formerly occupied by the late General Otto H. Falk, which has been vacant since his death in 1940.

NEW OFFICERS FOR INSULATION FIRM

Effective January 1, Edward A. Wilson, Jr., who is in charge of sales in the Detroit area, was elected secretary of Grant Wilson, Inc. Theodore O. Dallman, who has been manager of operations, was elected vice-president, and Myron W. Mitchell, who has been manager of accounts, was elected assistant treasurer.

The other officers and directors were re-elected.

ELECTED DIRECTOR OF NIAA

Walter A. Bowe, advertising and public relations manager of the Carrier Corp., has been elected director at large of the National Industrial Advertisers Association, Inc., to fill the unexpired term of R. D. Hawkins who has resigned.

Mr. Bowe, long active in NIAA affairs, is nationally known as a well-informed author and speaker on subjects concerning the various aspects of advertising.

TO DRAFT CODE FOR PROTECTION OF FOUNDRIES

Recently the government requested the foundry industry to draft a set of rules and recommendations to be used as a guide in providing safeguards for foundries during wartime so that maximum operating capacity will not be endangered. In answer to this request, the American Foundrymen's Association, 222 W. Adams St., Chicago, has formed a committee to draft such a code of rules for protection of foundries and properties in wartime. The committee will function under the safety and hygiene section of the association and will be under the chairmanship of James R. Allan.

Black and white reproduction from the all-color film showing the 7000 F electric arc

Message to Garcia 1942 Style

In '98, Rowan struggled in the jungles of Cuba three weeks to deliver his message to Garcia. Today, there is hardly a military commander in any American outpost--from Iceland to the Philippines--who can't be reached in an hour or less from Washington, by plane or telephone or short-wave radio.

In this revolution in communication, steel has had a vital part. Steel not only goes into the delicate instruments of the Signal Corps, but also plays essential roles in the form of conduit, copperclad steel wire, aerial towers, and other equipment of many kinds.

For many months, a sizable percentage of Youngstown's production has been going into materials for defense use, including the Signal Corps -- conduit, pipe, wire, rods, bars, shapes, sheets, strip and plate. As we help to speed messages by the hundreds of thousands to our modern Garcias, we are insuring that tomorrow America may enjoy the peacetime products of our mills and factories.

Youngstown products include Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Tin Plate - Rods - Wire - Nails - Tie Plates and Spikes

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Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1942, HEATING, PIPING & AIR CONDITIONING and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

New Motor

No. 2222—"Safety-Circle" protection of the new "Lo-Maintenance" motors has been specially developed to give the motor complete all around protection. The safety circle is a wide solid rib, integrally cast as part of the frame, which forms an unbroken circle of protection around the stator.

Following are other features stressed by the manufacturer: One piece cast frame and cast end shields guard the motor from exterior knocks and abuse. A more liberal use of electrical materials makes this motor internally and electrically stronger because current and magnetic densities are less extreme. Improved bearing design delivers smoother performance with full flow lubrication and easier maintenance. Additional cross strength has been built into the distortionless stator for maximum power efficiency.

Rotor is keyed to the shaft for strength, and its outer surface is turned for smoothness and an accurate air gap. Oil drains are at bottom of bearings for easy flushing. There are removable end brackets, and a large conduit box for handy wiring.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

For Your Convenience

[2-42]

HEATING, PIPING & AIR CONDITIONING,
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature."

(Circle each number in which you are interested)

2222 2223 2224 2225 2226 2227 2228 2229 2230 2231
2232
4094 4095 4096 4097 4098 4099 4100 4101 4102 4103
4104 4105 4106 4107 4108 4109

Name.............................. Title..................

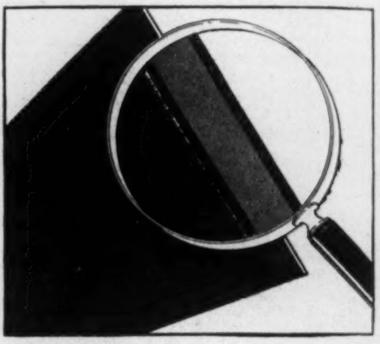
Company ....

Address ....

City.............................. **State**..................

Substitute for Sheet Metal

No. 2223—A substitute material for use in place of sheet copper and other sheet metals has been developed, and is now offered for either defense or non-defense construction, as no priorities are necessary, according to the maker.

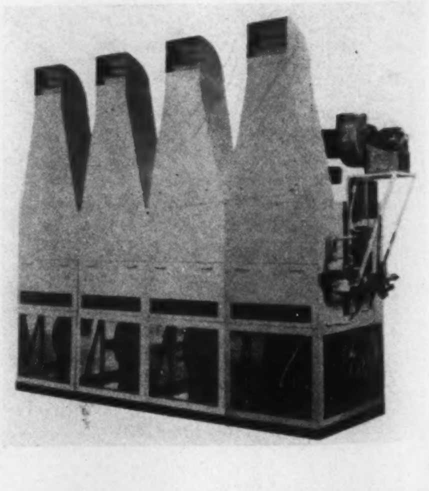


The new material, called "Pitch-on-Metal," is made with a ferrous metal core, enclosed in a baked on coal tar pitch, is not affected by moisture or cement mortar, and is resistant to most acid conditions, says the manufacturer.

In addition to its use for flashing, this product is available in regular sheet form for ducts, counterflashing, gutters, downspouts, gravel stops, termite shields, etc. It can be painted any desired color provided one coat of shellac is applied after all fabrication is completed.—Cheney Co., Ardmore, Pa.

Heavy Duty Unit Heater

No. 2224—A heavy duty unit heater added to the line of "Janitrol" gas fired space heating equipment is designed for the heating of large buildings such as airplane hangars and skating rinks, and factory buildings such as locomotive shops, steel mills, storage warehouses, arsenals and the like. The design incorporates the "Multi-Thermex" heat exchanger and "Amplifire" burner, both exclusive features.

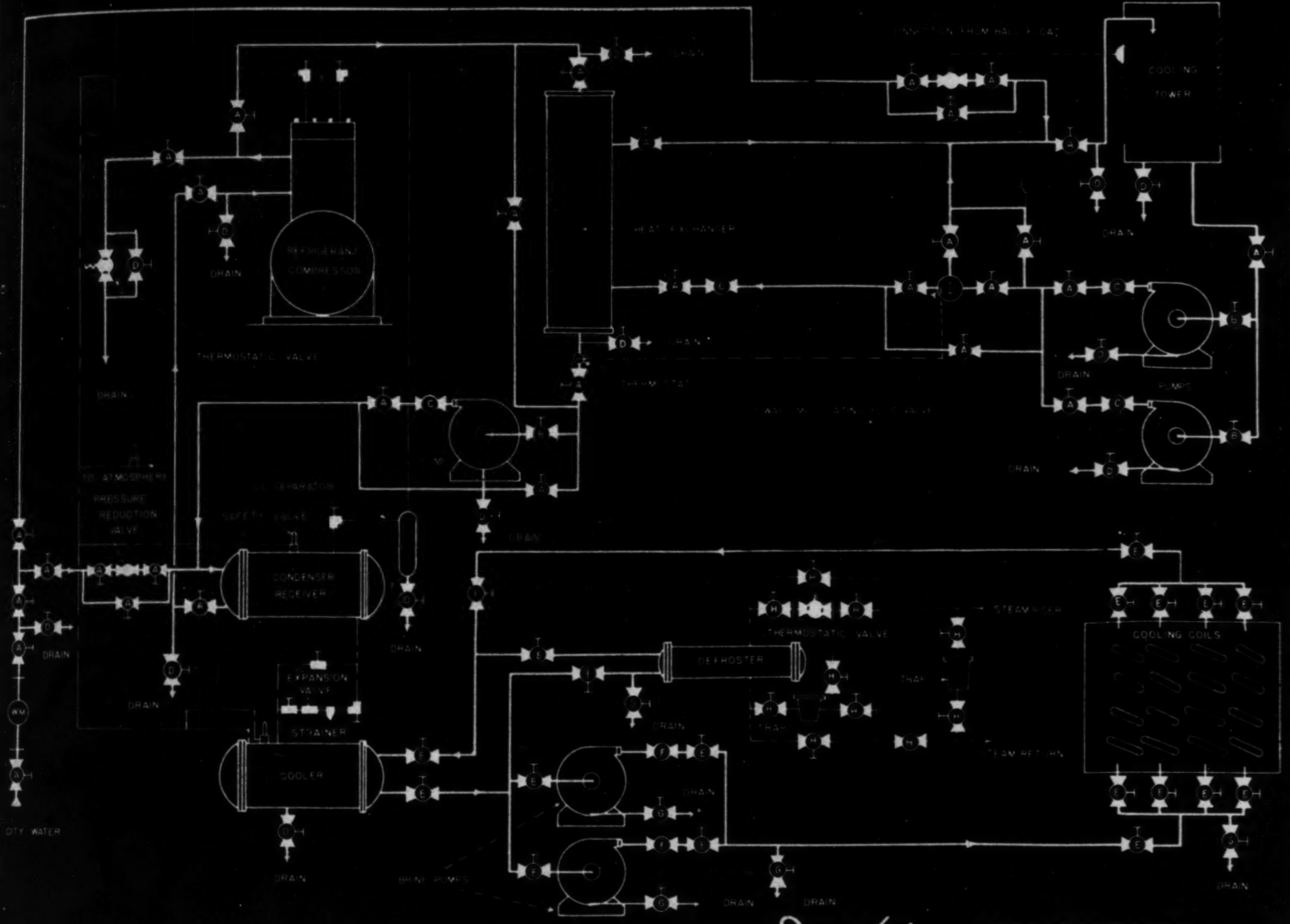


The unit is built up of a series of sections, each section having an input rating of 250,000 Btu per hr. Each section is complete, having its individual heat exchanger as-

GOOD VALVE PRACTICE

A TYPICAL BRINE-COOLING SYSTEM

With Steam Defrosted Coils


CONNECTION FROM BALL FLOAT
COOLING TOWER
HEAT EXCHANGER
REFRIGERANT COMPRESSOR
DRAIN
THERMOSTATIC VALVE
THERMOSTAT
WATER REGULATING VALVE
PUMPS
TO ATMOSPHERE
PRESSURE REDUCTION VALVE
OIL SEPARATOR
SAFETY VALVE
CONDENSER RECEIVER
EXPANSION VALVE
STRAINER
COOLER
WM
CITY WATER
BRINE PUMPS
DEFROSTER
THERMOSTATIC VALVE
STEAM RISER
TRAP
STEAM RETURN
COOLING COILS

Jenkins SUGGESTS

REFERENCE CHART FOR JENKINS FIGURE NUMBERS			
A COOLING WATER GLOBE	Fig. 106-A		Bronze
B COOLING WATER GATE	Fig. 368		Bronze
C COOLING WATER SW. CHK.	Fig. 92		Bronze
D WATER DRAIN GL. OR ANG.	106-A or 108-A		Bronze
E BRINE LINE U-BOLT GATE	Fig. 40-A		All-Iron
F BRINE LINE SWING CHECK	Fig. 623-AI		All-Iron
G BRINE LINE DRAIN GLOBE	Fig. 75-DA		All-Iron
H STEAM SUPPLY GLOBE	Fig. 106-A		Bronze
I STEAM SUPPLY SWING CHECK	Fig. 92		Bronze

This is a typical example of a brine cooling system with steam-operated defrosting equipment for the coils. This method of defrosting averts the possible damage to furs caused by live-steam spraying. In this system, the cooling water for compressor and condenser is supplied through a closed circuit. This cooling water is cooled in turn through a heat exchanger by a cooling tower circuit, preventing corrosion from occurring in machinery. The cooling tower circuit is arranged so water circulates constantly, regardless of cooling demand, to prevent freezing. Clean water is kept in one closed circuit, contaminated water in a separate closed circuit.

THERE'S ONE sure thing you can bank on in the engineering of any plant. And that is that *no system can be any better than the valves that operate it.*

You can get the best valves – with the longest, most trouble-free service – by specifying Jenkins Valves. And in the Jenkins line you will find valves covering every heating, piping and air conditioning need, *priced at no premium.* Next time, specify Jenkins.

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VALVES

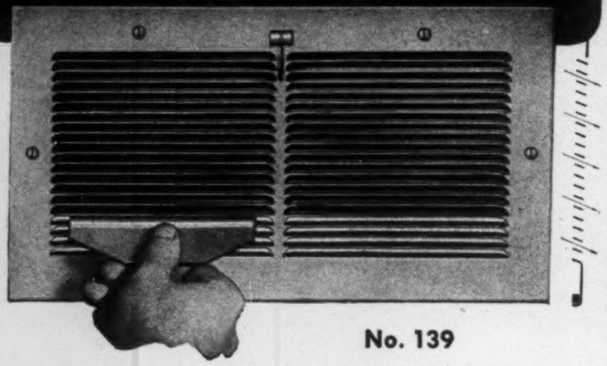
Diagram by
Huxley Madeheim,
Consulting Engineer

ENKINS VALVES BRONZE IRON STEEL FOR EVERY NEED

INDEPENDENT

WROUGHT STEEL

Air Conditioning Registers



No. 139

Flexible Grille Bars Make Adjusting Easy

Always Leading. Always Progressing

This modern Independent register has attained great popularity because it presents fine appearance and high efficiency at moderate cost. The grille bars are formed of sheet metal and come regularly adjusted to direct air flow slightly downward. Being flexible, they can be bent to direct air flow to any other desired angle, upward, downward or straight outward. Materials and workmanship are of first quality. Valve is positive, free working and stays firmly in position.

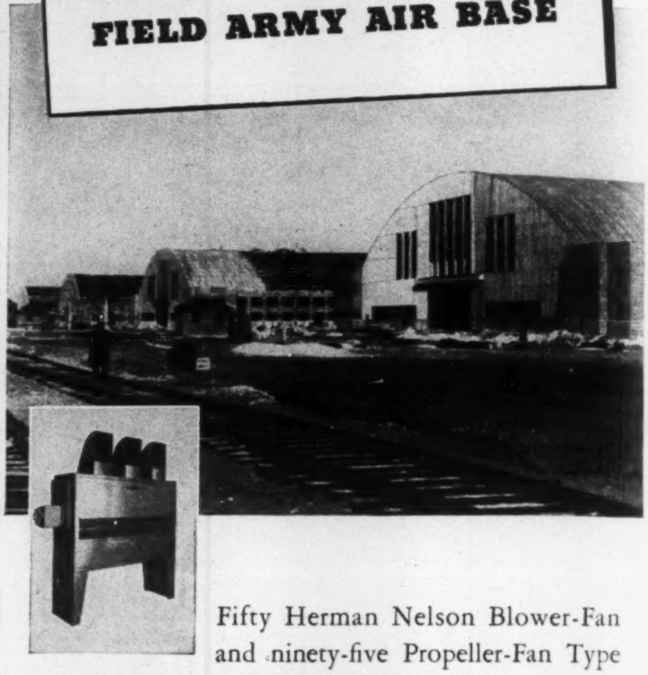
Write for Catalog 41-AC

THE INDEPENDENT REGISTER CO.

3747 EAST 93rd STREET

CLEVELAND, OHIO

HERMAN NELSON hiJet HEATERS INSTALLED AT WESTOVER FIELD ARMY AIR BASE



Fifty Herman Nelson Blower-Fan and ninety-five Propeller-Fan Type hiJet Heaters have been installed in the hangars of Westover Field Army Air Base at Chicopee Falls, Massachusetts. These heaters are large enough to heat 550 average size homes.

Herman Nelson hiJet Heaters have been installed in hundreds of buildings at Air Bases, Navy Yards, Arsenals, Camps and Forts vital to National Defense. The complete line of hiJet Heaters includes Horizontal Shaft Propeller-Fan, Vertical Shaft Propeller-Fan, Blower-Fan and De Luxe Types. There are 263 models, sizes and arrangements, so you can select the exact unit to solve practically any heating problem most satisfactorily and economically.

AUTOVENT FANS AND BLOWERS have also been installed in many Defense Projects. This quality equipment is manufactured by the Autovent Fan and Blower Division of The Herman Nelson Corporation. All Autovent Products are tested and rated in accordance with the Standard Test Code as established by the National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers.

Autovent Type HB Blower

herman nelson moline illinois

THE HERMAN NELSON CORPORATION

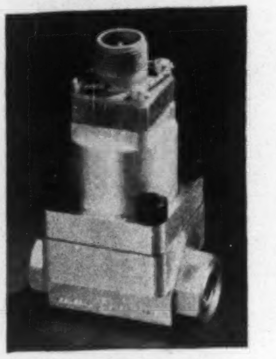
MOLINE, ILLINOIS

Manufacturers of Quality Heating, Ventilating and Air Conditioning Products

sembly, pilot, limit control and blower. The blowers of all the sections are mounted on a common shaft and driven by one motor. All sections are securely attached to a heavy channel iron base to insure ruggedness and alignment of the fan shaft.—Surface Combustion Corp., 2375 Dorr St., Toledo, Ohio.

Valves for Vibrating Machines

No. 2225—A new line of electric valves, designated as series "PV," has been specifically designed for positive valve operation on moving equipment and vibrating machines. Applications include airplanes, buses, trucks, tanks, tractors, railroad cars, ships, boats, machine tools, etc.



These valves will handle all types of liquids, gases and vapors, including refrigerants, greases, gasoline, alcohol, anti-icing fluids, etc., under pressures from a fraction of a pound to 1500 psi or more, says the maker. Operation in any position, packless construction, drip proof design, and minimum current consumption are additional advantages.—General Controls Co., 801 Allen Ave., Glendale, Calif.

Reclaimed Rubber V Belts

No. 2226—If the results of WPB's study of the overall rubber situation permit, "Victory" v belts made entirely of reclaimed rubber which will give 80 per cent of customary service without drawing on the nation's crude rubber stockpile will be manufactured, it was announced last month.

This means that the industry and the public can cooperate in the nation's rubber conservation program and still keep in operation "automobiles that need fan belts, as well as washing machines, refrigerators, oil burners, ironers, home machine tools, air conditioners, water pumps and thousands of other typically American labor saving devices," according to the announcement.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Air Cooling Units

No. 2227—The drip pan under small air cooling units is usually more than ample for all normal conditions. However, in a few localities the humidity is sometimes so high that water is removed from the air faster than it can evaporate. The problem was to get rid of this water without the nuisance of a drain connection.

One day an engineer stood beside one of these machines in the laboratory. Puzzling over this problem, he chanced to touch the blade of a screwdriver to the water in the drip pan in front of the condenser fan. To his surprise water climbed up the blade, was blown off in a fine spray and evaporated. Here was the answer to the problem. Air blowing past the screwdriver standing at an acute angle created behind the blade a vacuum that drew the water upward to form a spray.

Now, by fastening a flat curved strip of metal so that one end dips in the tray, excess water is blown into

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SPECIFY AND INSTALL
DOREX ODOR ADSORBERS

If production must continue 24 hours a day, are dollars an exception? Get the most out of every one by specifying Dorex Odor Adsorbers on your air conditioning installations. Here's why:

Dorex Odor Adsorbers economically remove odors that spoil products and impair workers' health or efficiency. But of greater interest to you, they make possible the recirculation of large quantities of inside air, thereby reducing the load on the air conditioning system and cutting **operating costs.** Dorex Odor Adsorbers will govern the size of an air conditioning installation. Even when a system is geared to operate at maximum efficiency, Dorex will improve results.

Your customers **need** Dorex Odor Adsorbers. And remember: every saving on an air conditioning job is a vital contribution to equipment, fuel and power conservation. Investigate Dorex Odor Adsorbers without delay.

Dorex Odor Adsorbers employ the one positive means of actually removing odors—carbon adsorption, the principle of the gas mask. There are units for every type of odor problem. Don't fail to investigate Dorex Odor Adsorbers before specifications are written. Write today for Bulletin 101, "What Dorex Odor Adsorbers Mean to Air Conditioning."

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SPECIFY
DOREX Kno-Draft
AIR DIFFUSERS
They're Draftless . . .
. . . and adjustable too!

"WORKS LIKE A GAS MASK"
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"KEEP 'EM FLYING"

Photo Courtesy of Curtiss-Wright Corp.

BY
SAFE-GUARDING
STEAM LINES
AT ARMY AND
NAVY AIR
BASES

From Pearl Harbor to Newfoundland; from Alaska to Pensacola; from San Antonio to Wright Field, the ADSCO Internally-Externally Guided Expansion Joint safeguards hundreds of miles of steam, hot water, fuel oil and gasoline lines by controlling expansion and contraction of pipe lines to hospital buildings, hangars, shops, and warehouses.

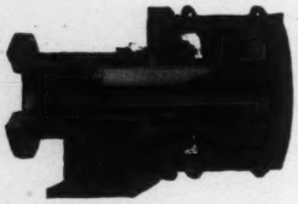
This completely guided joint meets Army and Navy specifications, and also has been approved for many years by leading mechanical engineers for installation in industrial plants, colleges, institutions, and railroad terminals.

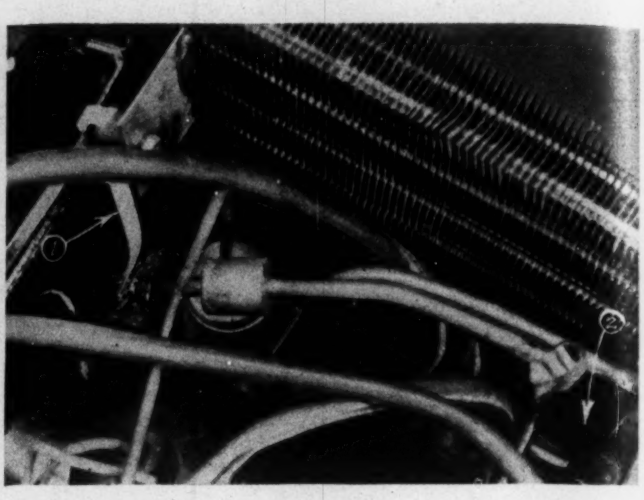
The ADSCO Internally-Externally Guided Expansion Joint and other ADSCO products such as tile conduit, wood casing, meters, water heaters, steam traps, etc., reflect over 60 years experience in the manufacture of steam distribution equipment. For detailed information on ADSCO Products, write for Catalog No. 35HP.

AMERICAN DISTRICT STEAM COMPANY NORTH TONAWANDA, N. Y.

Making "UP-TO-DATE" Steam Line Equipment for Over 60 Years.

ADSCO INTERNALLY EXTERNALLY
GUIDED JOINT

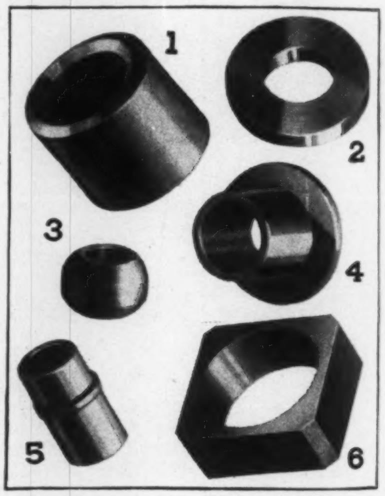




a spray as rapidly as it collects. Arrows in the photo indicate the strips.—Westinghouse Electric & Mfg. Co., Springfield, Mass.

Iron Bearings to Save Copper

No. *2228*—The addition of "Selflube" porous iron bearings to a line of self-lubricating bronze bearings has been announced. The new porous iron bearings are stronger than porous bronze bearings, and they are interchangeable with porous bronze bearings in most applications. They were introduced to conserve copper. These bearings are made from powdered iron, which is molded to size in the shape desired, then baked, and finally saturated with oil.



The bearings are supplied in both standard and special shapes, as shown in the illustration: (1) sleeve or plain cylindrical bearings, (2) washer or thrust bearing, (3) spherical or self-aligning bearing, (4) flanged bearing. Examples of special shapes are shown at (5) and (6).—Keystone Carbon Co., Saint Marys, Pa.

Larger Pump Unit

No. *2229*—Added to the line of recently introduced "Electrifugal" single unit pumps is a new 25 hp unit. Like the smaller sizes in the line, the new pump is built as one unit, with both motor and pump on one shaft and in one housing.

This design offers many advantages, says the maker, among which are a 33 per cent saving in space, only three section-fits as compared to five or more, better shaft alignment, less vibration, less wear, easier installation and lower pumping costs. The addition of the new unit to the line now makes available a full range of sizes and types from ½ to 25 hp.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

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AIR CONDITIONING
Power Units

with full **AUTOMATIC CONTROL, Heat Exchanger, and Automatic Clutch**

These "Red Seal" power units are completely equipped for full automatic operation using natural gas for fuel. Cooling system functions by passing water from regular building supply through heat exchanger which replaces radiator and cooling fan.

Standard equipment also includes electric starter — storage battery — trickle charger — thermostat — automatic control — governor — gauges — oil filter and safety switches.

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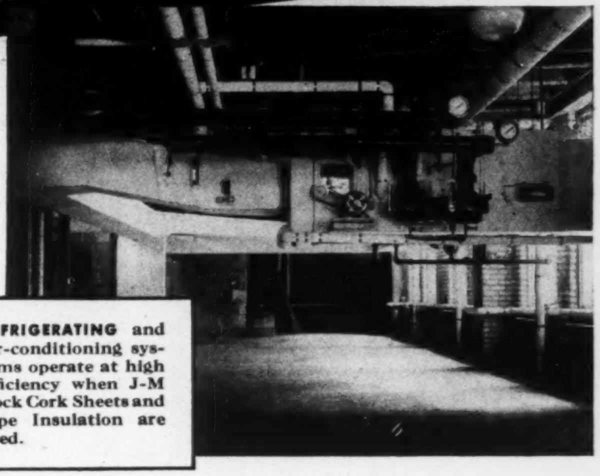

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PERMANENT EFFICIENCY? Rock Cork is the answer! For more than a quarter-century, this basically mineral, unusually moisture-resistant insulation has been demonstrating its ability to withstand the severe punishment of low-temperature service. Hundreds of installations made years ago are still in excellent shape . . . promise many more years of dependable, economical service.

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RiP-Clean Filters Triple Filter Life

You cut the cost of clean air and extend filter life with the new RiP-CLEAN Air Filter!

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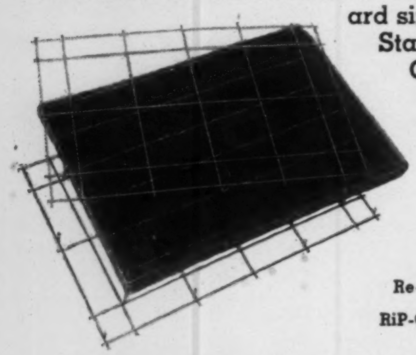

No. 200 Series Re-Fil-Able Research Air Filter—RiP-CLEAN Construction

RESEARCH AIR FILTER

RESEARCH PRODUCTS CORPORATION
MADISON, WISCONSIN

Rotary Pumps and New Strainers

No. 2230—A line of direct-connected rotary pumps is furnished in standard capacities of 5, 10 and 20 gpm for pressures up to 100 psi; operating speed is 1800 rpm. Standard units consist of the pump mounted on a bedplate with a flexible coupling for direct connection to an electric motor, steam turbine or gasoline engine. Pumps for belt drive complete with tight and loose pulleys and belt shifter are also available. Pumps only are furnished for use as original equipment on various types of machines. The compact size of the pump requires small mounting space.

A new high lift, nonchatter relief valve is built in as an integral part of the pump casing. The valve will bypass the entire capacity of the pump without causing shock or end thrust on the working parts, according to the manufacturer.

The same company has also put on the market a series of strainers for pipe sizes from 1 to 6 in., which incorporate a number of improvements. Known as "Ezy-Kleen" they are suited to applications with all types of pumps, or wherever a strainer is required in a piping layout.—Blackmer Pump Co., 1809A Century Ave., S.W., Grand Rapids, Mich.

Lead-Silver Solders

No. 2231—According to a recent report of the American Silver Producers' research project, now in charge of Handy & Harman, 82 Fulton St., New York, N. Y., two types of lead-silver solders containing no tin are finding increasing use. One of these is the eutectic alloy which contains 2½ per cent silver and 97½ per cent lead. It flows at about 580 F. The other is a proprietary alloy composed of 2.5 per cent silver, 0.25 per cent copper and 97.25 per cent lead. It starts to melt at about 580 F. and flows at about 660 F. These are relatively "soft" solders and should not be confused with the silver brazing alloys and "hard" silver solders having melting points of 1175 to 1600 F.

In suggesting the use of the above lead-silver soft solders, the report points out that a lead-silver solder containing 2.5 per cent silver costs less than lead-tin solders in which the tin content is above 25 per cent.

Camouflage Paint

No. 2232—A new type of low visibility paint, possessing heat deflecting qualities, has been developed for use in the protective concealment of structures and equipment. The new paint meets tentative navy specifications for infra-red reflecting paints for use on fuel storage tanks, buildings, and certain types of equipment where dark colors as well as heat reflecting qualities are required, the maker states.

Offered commercially under the trade name of "Infray" it is manufactured in green, tan, black and four intermediate shades which, when properly selected, will meet the requirements of camouflage in any sort of terrain. All seven shades are hard to see from the air and throw off most of the heat of the sun's rays that would normally be absorbed, it is said.—Arco Co., Cleveland, Ohio.

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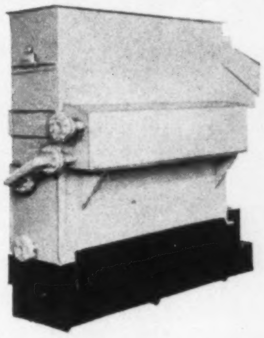
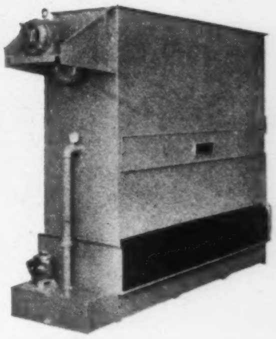
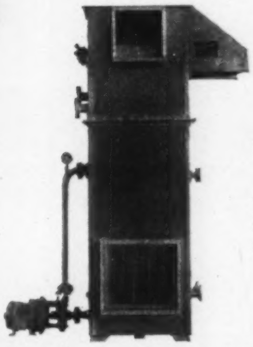
EVAPORATIVE CONDENSERS
for industrial refrigeration lower condensing temperature, save power and water, increase the life of equipment.



NIAGARA EVAPORATIVE
LIQUID COOLERS
save power and prevent troubles in jacket water cooling, quenching oils, industrial fluids.



NIAGARA *No Frost* METHOD
with Spray Coolers protects quality in fresh and frozen foods, saving power and equipment cost without icing of coils in sub-zero temperatures down to −50° F.



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give precise control of temperature and humidity for processing hygroscopic materials.

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Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 100. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Air Cleaning

No. 4094—Mailing piece featuring the importance of clean air in production for victory and as a vital need in national defense. Various types of air filters and dust collectors are illustrated.—American Air Filter Co., Inc., 107 Central Ave., Louisville, Ky.

Air Conditioning Units

No. 4095—Series of 2 p. bulletins (41B2, 3, 4 and 5) describing line of air conditioning units providing a size and capacity to meet the requirements of many types of industrial and commercial establishments. The units were especially designed for applications where it is desirable or necessary to use ducts to distribute the conditioned air. They are entirely self-contained and are shipped from the factory completely assembled.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Air Diffusers

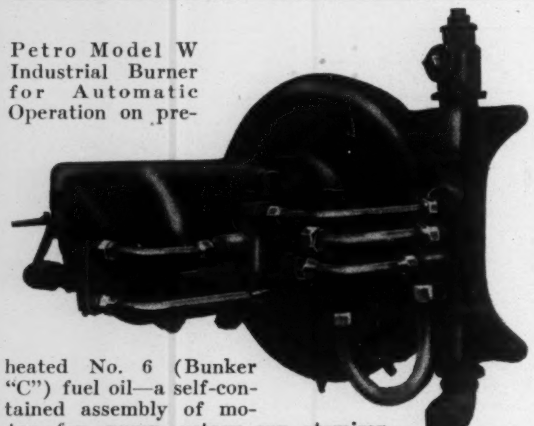
No. 4096—20 p. catalog on the steel "Aerofuse" outlet for providing "maximum air mixture, rapid temperature equalization, perfect air distribution and elimination of drafts." The five standard types are detailed and a number of special adaptations are also shown. Other constructions are in the process of development and are to be offered to the industry in the near future. Installation instructions are included and there are numerous tables for selection, data on accessories and design factors.—Tuttle & Bailey, Inc., Corbin Ave., New Britain, Conn.

Blow Torches

No. 4097—16 p. booklet, entitled Torch Pointers, devoted to the use and care of blow torches. Designed primarily for instruction of trade school students and apprentices, the text and illustrations describe component parts of a blow torch, operating principles, best methods of filling, starting and stopping, and there are sections on trouble shooting, hard and soft soldering, brazing, sweating, etc.—Clayton & Lambert Mfg. Co., 11111 French Rd., Detroit, Mich.

Butterfly Valves

No. 4098—16 p. catalog (10-B) on standard and special butterfly valves for the control and tight shutoff of air, gas, steam, liquids and semi-solids under high and subzero temperatures and various pressures from 2 to 300 psi. Performance characteristics under various service conditions are included, manual and automatic control are discussed, flow charts are reproduced and there are discussions of the use of various metals for special conditions. There is also an explanation of wedge-tight shutoff by means of accurate machining, and the angle



Petro Model W Industrial Burner for Automatic Operation on preheated No. 6 (Bunker "C") fuel oil—a self-contained assembly of motor, fan, pump, rotary cup atomizer and interlocked air and oil adjustments.

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Cut Steam Costs —*for reasons familiar to good heating men—such practical reasons as:*

1. Each Petro System is designed to meet and handle efficiently the operating necessities and characteristics of the plant it is to fire.
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FOR AUTOMATIC—SEMI-AUTOMATIC— or MANUAL OPERATION

Capacities—to 145 gallons per hour—454 Boiler h.p.—68,000 Sq. Ft. Steam

PRIORITIES: With Petro's entire manufacturing facilities now subject to the needs of our Victory production program, our production of oil burners is obviously governed by priorities. In addition to new plants for war-material, however, it is obviously necessary to maintain efficient operation in existing plants (production or housing) which contribute to the Victory program. Government recognition of this need is backed by priorities which every district Priorities Office is authorized to issue to cover repairs to, or replacement of, outworn or inefficient firing equipment. Petro is well experienced on deliveries for such equipment, and will be glad to assist Contractors in any way possible to expedite such work.

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of closing of the butterfly vane against the body of the valve is featured.—R-S Products Corp., Germantown Ave. at Wayne Junction, Philadelphia, Pa.

Condensate Return System

No. 4099—4 p. bulletin (3025) describing new high pressure condensate return system, listing 50 different industries in which appreciable increases in production rates and fuel savings are being made by the use of this unit in draining jacketed kettles, drying rolls, coil cookers, dryers, unit heaters, laundry and platen presses, and similar equipment depending on uniformly high steam temperatures for efficient operation. A typical installation is described in detail with a four color illustration showing steam, condensate and make-up lines.—Cochrane Corp., 3161 N. 17th St., Philadelphia, Pa.

Controls

No. 4100—52 p. catalog (51) describing and giving specifications and prices for a complete line of controls including low and line voltage thermostats, tank thermostats, magnetic gas valves, motor operated gas valves, slow opening gas valves, gas regulators, safety controls, diaphragm valves and switches, fuel governors, strainers, transformers, thermal expansion valves, stop valves, butterfly valves, relays, low water cutouts, oil heating package sets, gas heating package sets and numerous other items.—General Controls Co., 801 Allen Ave., Glendale, Calif.

Electric Heating Units and Controls

No. 4101—40 p. catalog (28-000) devoted to electric heating units and controls for industrial applications involving the heating of liquids, solids or air. Specifications, descriptions, ratings and prices of the following types of heaters are covered: (1) strip heaters for use in ovens, crane cabs, valve houses, pipe lines, process machinery, etc.; (2) finned strip heaters for forced air ducts, blower units or convection heaters; (3) cartridge heaters for spot heating; (4) oil and immersion heaters; (5) air and oven heaters; (6) melting pots; (7) glue pots. Seven pages of application data and selection information are included, with typical examples of heating problems showing the solutions.—Westinghouse Electric & Mfg. Co., Mansfield, Ohio.

Electric Steam Radiators

No. 4102—4 p. bulletin on "Electresteem" portable steam radiators with a self-contained "boiler" running the full length of the radiator and so constructed that no more than 3/8 in. of water is in contact with the element tube at any one time. Power consumption is 900 watts, 110 volts, universal a-c or d-c, with other voltages and wattages available on request.—Electric Steam Radiator Corp., 6188 12th St., Detroit, Mich.

Flexible Couplings

No. 4103—Selector charts for choosing the right flexible shaft coupling for light or heavy duty—the size, the bore, the horsepower and the rpm for a range of couplings for various duties from 1/6 hp for pumps and small equipment to 16¾ in. bore for heavy duty in steel mills.—Lovejoy Flexible Coupling Co., 5024 W. Lake St., Chicago, Ill.

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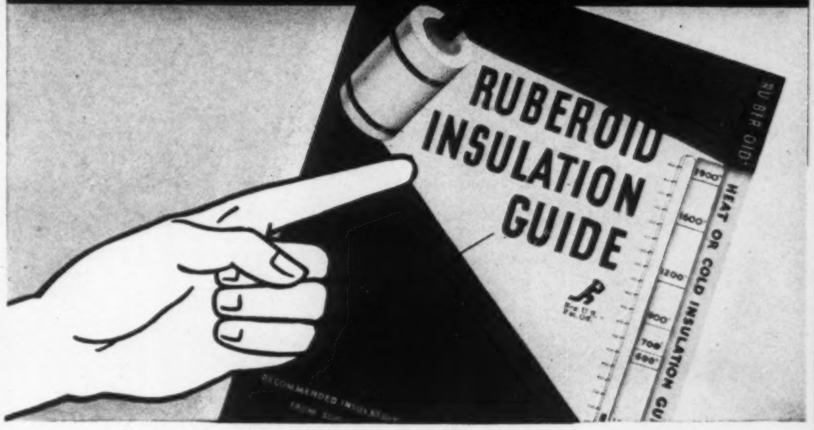
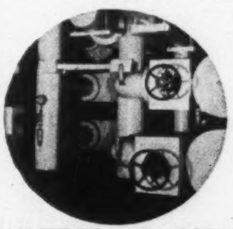


Handy, factual file tells you proper insulation to solve cold and heat control problems from sub-zero to 1900°F



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All three contribute to insulation efficiency. The Ruberoid Co. offers you all three to custom-build each insulation job. Should any Ruberoid insulation product be temporarily withdrawn from the market, or priority orders make deliveries long delayed, Ruberoid will suggest other insulating materials that may be substituted without the loss of efficiency.

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It contains valuable information and in a form that gives you facts at your fingertips. No wading through *many* pages to find the temperature you're interested in—the index tells you at a glance!

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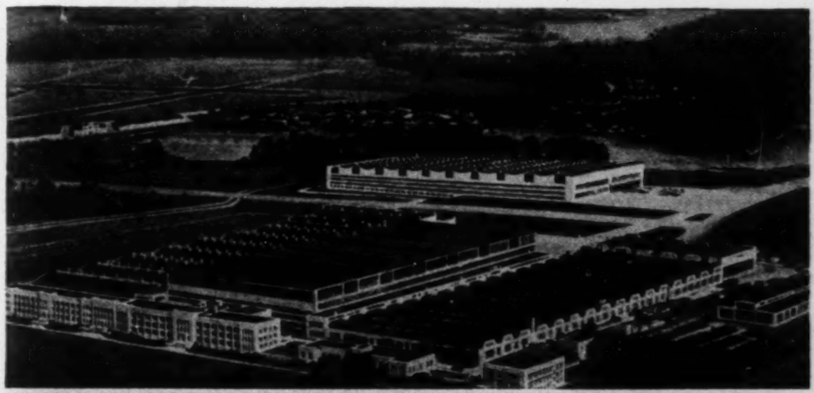

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Insulation
For HEATING · COOLING · AIR CONDITIONING

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DOLE No. 1A VARI-VENT AIR VALVE

The No. 1A Vari-Vent is outstanding in an All-Star line, for balancing the flow of steam to radiators of oil, gas or stoker-fired systems at the first breath of boiler pressure. The new domed adjustment cap adds eye-appeal—improves venting.

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For balancing the flow of steam to convectors, either cast iron or copper, of oil, gas, or stoker fired systems. Extra large venting port permits efficient heating from low boiler pressures.

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For venting steam mains and speeding up the flow of steam to radiators of automatically fired systems. Specially recommended for use in conjunction with Dole Vari-Vent Air Valves No. 1A or No. 1B.

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This valve is for venting radiators and "vacuumizing" gravity steam heating systems for most economical operation. It has the patented Dole bellows, vacuum feaure that locks out air after it has been once expelled from the system.

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Heat Diffusers

No. 4104—Series of four 2 p. data sheets (46P-1, 46P-2, 46Q-1 and 46R-1) for heat diffusers available in four models designed to provide economical heating for large spaces, such as factories, warehouses, hangars, garages, armories, gymnasiums and similar buildings. Sectionalized construction permits adaptation of a single unit to a variety of positions and conversion of one type of unit into any of the other types after installation. There are models for floor mounting, vertical suspension and horizontal suspension. These diffusers can be installed with the "Thermadjust" feature which employs bypass dampers to regulate the volume of heated and bypassed air in order to balance the heat output of the unit with the heating requirements of the space. —Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Motor Bearings

No. 4105—Issue of The Motorgram (Vol. 22, No. 1) with notes on the selection of motor bearings, describing various types and their importance.—Bodine Electric Co., 2254 W. Ohio St., Chicago, Ill.

Pump Data

No. 4106—6 p. bulletin (302) of engineering pump data containing comprehensive tables of friction losses in pipes, valves and fittings; viscosity conversion tables; tables of practical suction lifts; viscosity of various liquids at different temperatures; and other information required in the installation of pumps and design of piping layouts.—Blackmer Pump Co., 1809A Century Ave., S.W., Grand Rapids, Mich.

Refractory Maintenance Coating

No. 4107—4 p. bulletin on "Greencote" refractory maintenance coating for reconditioning furnace linings, showing examples of applications and describing method of use.—A. P. Green Fire Brick Co., Mexico, Mo.

Stainless Steel Valves

No. 4108—16 p. booklet on stainless steel gate, globe and angle, lift, check, swing check, and Y valves for control of acids, alkalies, chemicals, industrial solvents and other fluids having corrosive qualities. Various types are illustrated and specifications and dimensions are given. An innovation is "certified castings," each casting being x rayed as well as pressure tested.—Jenkins Bros., 80 White St., New York, N. Y.

Steam Coils for Air Conditioning

No. 4109—16 p. catalog (450-12) on steam coils for air conditioning, including specifications and description, complete data on the selection procedure and capacity tables. This heating surface is electro-thermal bonded "to provide lasting and efficient thermal contact between the surface of the tubing and the collar of the fins." Effective tube lengths can be provided in any length up to 144 in. and specially designed coils may be supplied in any given face height, length, fin spacing or fin thickness, tube size or tube wall weight.—General Electric Co., Air Conditioning and Commercial Refrigeration Dept., 5 Lawrence St., Bloomfield, N. J.

Useful Information

New Series of Evening Courses on Defense

Northwestern University, Evanston, Ill., is planning on starting its third series of college level, tuition free, evening courses in the program of engineering training for defense. These courses are sponsored by the United States Office of Education and entail no expense to the man taking the course except for individual textbooks.

Of the 25 courses offered in the present series, three are of particular interest to HPAC's readers; ventilation and air conditioning; industrial air conditioning design; and public health, sanitation and water supply.

Each course meets two evenings a week on the Evanston campus. Registration will take place in the evenings from February 19 to 27, except on Saturdays and Sundays. Further information can be obtained by writing Defense Training Program, Northwestern Technological Institute, Northwestern University, Evanston, Ill.

Graphical Symbols for Use on Drawings

The American standard for graphical symbols for use on drawings in mechanical engineering, approved in November by the American Standards Association, has been published as ASA standard Z32.2-1941. Copies are available from the American Standards Association, 29 W. 39th St., New York, N. Y., for 50c each. This new standard supersedes American standard Z14.2-1935.

Sponsored by the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, the standard includes graphical symbols for piping, pipe fittings and valves, heating and ventilating, duct work, heat power apparatus, refrigerating equipment, welding, and plumbing.

Water Distributing Systems

Report BMS79 in the series on building materials and structures issued by the National Bureau of Standards, is devoted to water distributing systems for buildings. It was prepared by Roy B. Hunter and gives information relating to the selection of pipe sizes and design of distributing systems for adequate supply of water in buildings.

It contains flow charts showing the capacities of different commercial sizes of pipe in terms of friction loss in head for four degrees of roughness, depending on the pipe material and the character of water with which the pipe is used. A procedure is developed for the economical selection of pipe sizes for the different demands for each part, depending on the estimated demand and on the pressure available for friction loss as computed for particular service conditions. Suggested variations in the procedure provide means of allowing for decrease in capacities of pipes in service.

Copies of this 25 p. publication can be obtained from the Superintendent of Documents, Washington, D. C., for 15c.

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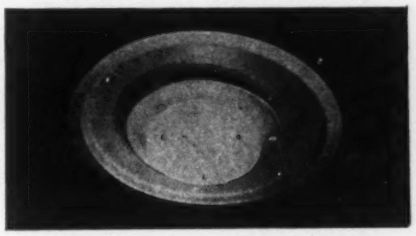

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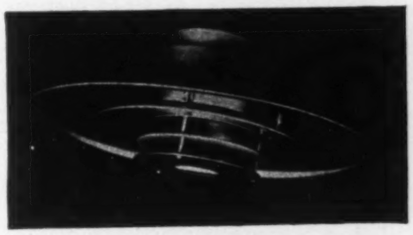

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Fig. 0851
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Properties of Earth Wall Constructions

Report BMS78 of the building materials and structures series issued by the National Bureau of Standards is devoted to the structural, heat transfer and water permeability properties of five earth wall constructions. It has been prepared by Herbert L. Whittemore, Ambrose H. Stang, Elbert Hubbell and Richard S. Dill.

The report covers studies made in connection with a program on investigations of low cost house constructions, carried on in cooperation with the Office of Indian Affairs and the National Youth Administration.

Copies of this 55 p. report are for sale by the Superintendent of Documents, Washington, D. C., for 20c.

Heat Transfer to Clouds of Falling Particles

Bulletin Series No. 330 of the Engineering Experiment Station, University of Illinois, Urbana, is entitled Heat Transfer to Clouds of Falling Particles, and was prepared by H. F. Johnstone, professor of chemical engineering, Robert L. Pigford, research assistant in chemical engineering, and John H. Chapin, formerly graduate student in chemical engineering. Until June 15, or until the supply available for free distribution is exhausted, copies may be obtained without charge upon application to the Engineering Experiment Station.

The investigation described in this bulletin was undertaken for the purpose of obtaining information essential to the design of equipment for heating finely divided

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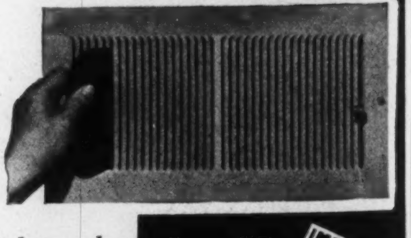

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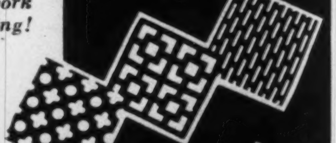

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materials falling through a gas. There is a growing interest in space reactions of solids, or between solids and gases, at high temperatures, because of the high rates of heat transfer to clouds of solid particles suspended in a gas. Because of the general applicability of the work, the results are presented in considerable detail along with the theoretical treatment essential to a complete development of the problem.

Seasonal Weather Forecasting

Supplement No. 45 of the Monthly Weather Review, issued by the Weather Bureau, is entitled Preliminary Studies in Seasonal Weather Forecasting. It has been prepared by Richard Hanson Weightman of the Weather Bureau, and is for sale by the Superintendent of Documents, Washington, D. C., for 30c.

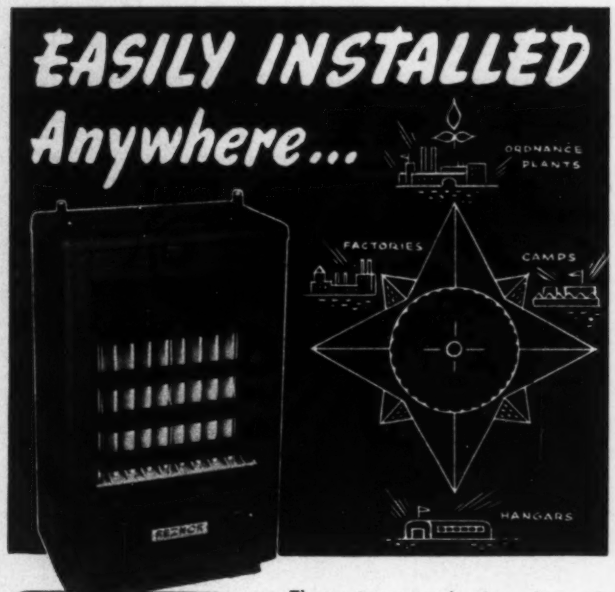
Blueprint Reading

The second edition of Simple Blueprint Reading with Special Reference to Welding, is concisely written in simple, practical language for easy understanding. It is intended that welders, mechanics and others will be enabled, by a few hours' spare time study of it, to learn print reading.

More than 50 drawings have been revised in the new edition of the volume, which is designed to aid and instruct anyone who must read blueprints, although the book has been especially published for those in the welding field.

The new book also contains eight new pages of drawings in addition to those previously used.

This 146 p. book is published by the Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio. Its price is 50c.



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Featuring this third edition are several entirely new chapters on phases of the subject not previously treated, including noise control, air conditioning measurements, air conditioning standards, fire protection codes and operating suggestions. Brand new designing examples are also used, together with new forms for recording the design data, the proper filling-in of which is explained step-by-step.

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Book Reviews

Oil Burner Service Manual

The new Oil Burner Service Manual, by Kalman Steiner and Fred Ravnsbeck, is a worthy companion text to Mr. Steiner's book on oil burners, which was first published in 1937. The new book is a manual giving information basic to installing and servicing oil burners, with special emphasis to service and to correction of faulty installations. Theoretical subjects are discussed only when the practical aspects would be incomplete without them.

The book is based to a considerable extent on the instruction manuals of manufacturers of various burner types and accessories, amplified by countless pointers secured from men actually engaged in handling such equipment. The latest trends in both burner design and control methods are discussed, and material has been included on older models as well as on current mechanisms.

There are chapters on domestic pressure atomizing oil burners, domestic vertical cup burners, rotary wall flame burners, low pressure atomizing domestic burners, miscellaneous domestic burners, horizontal rotary oil burners, miscellaneous industrial oil burners, refractories, tanks and piping, relays and circuits, automatic control instruments, boilers and warm air furnaces, load and burner capacity, draft and control, efficiency and testing, preheating, and service.

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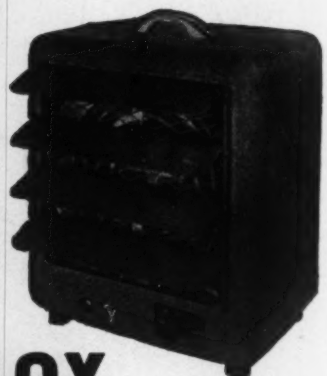

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If you use electric heat for industrial process heat, you know how really economical it is. If you don't, then check on the many Chromalox units which are everywhere speeding the production of war needs. Ask your power company, or write us. Keep the Chromalox Book of Electric Heat handy for instant reference. On request.

Above is the Type HF heater, available in four sizes from 1.5 to 4-KW. Other types up to 40-KW for heating factory space and other large areas. Thermostatic control if desired.

Use the expert aid of Wiegand engineers in working out your electric heat applications. Send sketch and description of your problem.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh, Pa.

Mr. Steiner is consulting engineer for the Ray Heat and Power Co., and is a member of HPAC's board of consulting & contributing editors. Mr. Ravnsbeck is chief engineer of the Ace Engineering Co.

This book, consisting of over 370 pp., is published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Its price is $4.00.

Industrial Instruments for Measurement and Control

Industrial Instruments for Measurement and Control, a new book by Thomas J. Rhodes, engineer, the Procter & Gamble Co., contains in one place more information on the various types of controls than has been available heretofore. Moreover, the information is well organized with logical divisions into chapters, and subdivisions of chapters. For this reason, the book should be of value not only to those who seek just a bird's eye view of the various types of industrial measuring and control instruments available, but also to those who need more detailed information.

The engineering information is complete enough to permit the reader to select and properly apply various types of instruments. Moreover, all through the book various practical pointers are mentioned which should help the inexperienced to avoid pitfalls in installation and use.

The book covers pressure and vacuum gages, indicating and recording thermometers, high temperature pyrometry, flow meters of many types, liquid level measurement, telemetering or remote indicating and recording, and it includes quite a good chapter on

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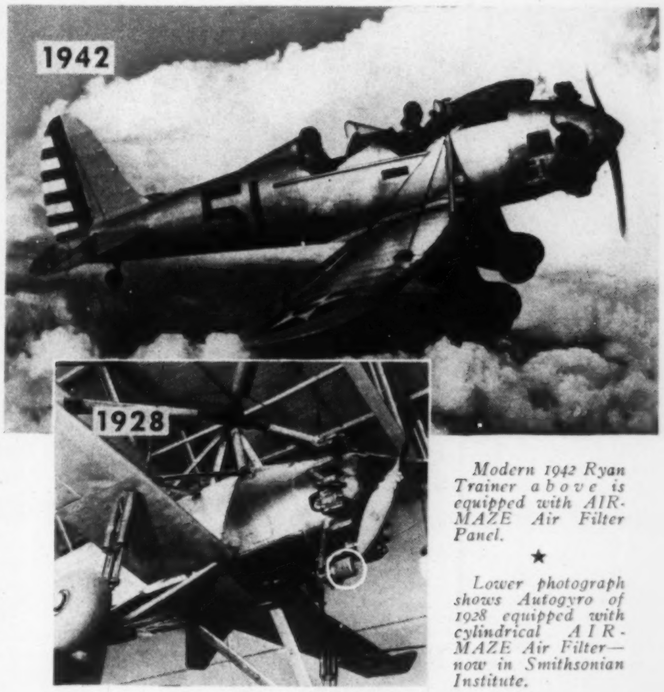

Modern 1942 Ryan Trainer above is equipped with AIR-MAZE Air Filter Panel.

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Lower photograph shows Autogyro of 1928 equipped with cylindrical AIR-MAZE Air Filter—now in Smithsonian Institute.

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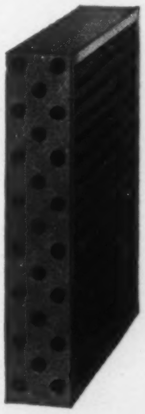

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automatic control as applied to industrial work.

Of particular interest to HPAC's readers should be the chapters on flow meters, liquid level measurement and temperature recording. These chapters are all excellent, the chapter on flow meters being outstanding.

Of particular interest to the mathematical minded reader is a chapter on the theory of automatic control. This chapter assembles in one place the mathematical information available heretofore only in many scattered scientific papers. However, the presence of this chapter need not frighten the practical minded. There is so much of a purely practical nature that the book should be of interest not only to students, but also to those who purchase and use instruments in their daily work.

This book is published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Comprising some 580 pp., its price is $6.00.

Welding Training

A new book prepared primarily to assist instructors in planning courses for the training of oxyacetylene welding and cutting operators has just been published by the International Acetylene Association. The book, entitled Training Oxy-Acetylene Welding and Cutting Operators—Instructors Outlines, is divided into three chapters. The first outlines the essential information that should be presented in a course for the training of a general welding operator, an aircraft welding operator, and a pipe welding operator. The second chapter contains in outline form the material that is essential

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Here is a patriotic tip, in behalf of metal conservation: Dart Unions, that have already given much efficient, trouble-free service and been "retired" or discarded, **are still capable of going back to active duty . . .** and of turning in a first-class performance. So, we suggest that a search be conducted throughout your plant to find and re-enlist your used Dart Unions in **your** particular Victory Effort.

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The manufacturers of Dart Unions are proud that old Darts as well as new ones are helping in this crisis. Remember—for **old** Darts search your plant and scrap piles of old pipe . . . for **new** Darts see your supplier today.

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Mail post card for free sample. Rutland Fire Clay Co., Dept. (H-2) Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patcher.

to the training of various types of cutting operators. The third chapter outlines the essential information that should be given in a course for inspectors and a specification of the primary requirements of students who take the inspector's course.

Copies of this 88 p. book can be obtained by writing to the secretary of the International Acetylene Association, 30 E. 42nd St., New York, N. Y. Paperbound copies are 25c each. A clothbound edition has also been prepared and can be obtained for 75c a copy.

Standards on Copper and Copper Alloys

A new publication, ASTM Standards on Copper and Copper Alloys, issued by the American Society for Testing Materials, provides in convenient form for ready reference the various specifications and tests issued by the society covering these products. The compilation, sponsored by committee B-5 on copper and copper alloys, cast and wrought, also includes specifications developed by committee B-1 on copper and copper alloy wires for electrical conductors and selected specifications prepared by committee B-2 on non-ferrous metals. There are some 73 standards covering a wide range of very important products, many of which are essential in the present war program.

There are nine specifications for various types of pipe and tubes—copper and brass boiler tubes, standard pipe, copper seamless tubes and water tubes. Among the standard tests are the new expansion (pin test) test for tubing and the mercurous nitrate test for copper alloys.

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√ Convenient
√ Complete

. . . That's the story behind the success of HEATING, PIPING and AIR CONDITIONING Annual Directory published each January. Its completeness, accuracy and convenience have made it indespensable to engineers and contractors throughout the year for reliable reference in their buying and specifying work. Further information sent on request.

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Also given are the standard tension and hardness tests and the extensive methods of preparing micrographs of metals and alloys, with the insert plate showing grain size standards.

Copies of this 350 p. publication in heavy paper cover can be obtained from the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., for $2.00 per copy.

Arc Welding

Practical Arc Welding, a 516 p. textbook by W. J. Chaffee, has been published by Hobart Trade School, Inc., Troy, Ohio. Its price is $2.00.

Part 1 is devoted to general welding information. Material covered includes the growth of arc welding; where arc welding is used; manufacturing applications; available metals and alloys; discussion of joints and welds; electrodes and filler rods; strength of arc welded joints; cost of arc welding; characteristics of the welding arc; welding symbols and their use; equipment for arc welding; and development of welding personnel.

Parts 2 and 3 are devoted to the complete series of arc welding lessons as they are offered in the Hobart trade school. Parts 4 and 5 contain a dictionary of welding terms and helpful tabular data for operators and designers.

Coming Events

Forced Warm Air Conference: 11th annual forced warm air conference, March 23-26, Michigan State College, East Lansing, Mich. Sponsored by mechanical engineering department of Michigan State, and National Warm Air Heating and Air Conditioning Association. For further information, write Professor Lorin G. Miller, Michigan State College, East Lansing, Mich.

Midwest Power Conference: April 9-10, Palmer House, Chicago, Ill. Sponsored by Illinois Institute of Technology, other midwestern universities and colleges, and local sections of engineering societies. Charles A. Nash, conference secretary, c/o Illinois Institute of Technology, Chicago, Ill.

Foundry Convention and Show: 1942 "win the war" convention and show, April 20-24, Cleveland, Ohio. American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

Heating, Piping and Air Conditioning Contractors National Association: 53rd annual convention, May 25-28, Hotel Schroeder, Milwaukee, Wis. George J. Stoehr is chairman of the local convention committee. Headquarters office of HPACCNA, 1250 Sixth Ave., New York, N. Y.

Industrial Advertisers: 20th annual conference, National Industrial Advertisers Association, to be held at Atlantic City, N. J., in September. Fred H. Pinkerton, United States Rubber Co., is general chairman of the conference.

THE EDITOR'S PAGES

EXPAND WAR GOODS PRODUCTION TO WIN

America must face the fact that it can win the war only if it provides a greatly expanded production of military goods during the rest of 1942, Chairman Donald M. Nelson of the War Production Board told a conference of business paper editors and publishers last month.

"Every weapon we make today is worth 10 that we might produce next year," Mr. Nelson said. "This year—1942—is the critical year in the existence of the United States. I'm not painting the picture darkly, but I do believe that we who know what American industry can do must look at the situation squarely and see what we can do to make up for lost time.

"We've lost a lot of time because industry was fearful of what might happen after the war if all our productive facilities were over-expanded. Let's stop thinking about what we'll do when it's all over and start thinking about what we're going to do now to prevent it from being all over for us.

"We've wasted the golden months in which we could have got fully ready—the months in which we could have expanded our steel industry, our chemical industry, our copper industry, and all the others, so that we would have plenty of everything. But we still have 10 silver months—the months which remain in 1942—and in them we can still do things that we never thought possible. The speed, energy, will and determination which we put into those months will determine what we'll think when those months are gone."

Getting maximum production at once, Mr. Nelson said, depends upon these things:

1) Getting greater production out of the plants and machines which are now producing war goods. Even though the country today is producing a much greater volume of armaments than in 1918, he said, the present volume is not nearly so great as it must become.

2) Getting military production out of factories and machines which are now producing civilian goods—in other words, by conversion of industry to full war production.

3) Enlisting the services of small producers, through subcontracting and through the letting of prime contracts to groups of small manufacturers who have pooled their facilities.

NEW APPLICATION BLANK FOR PRIORITY RATINGS

On February 2 a new form of application blank for individual preference ratings was made available by the division of industry operations of WPB. Use of the new form becomes mandatory March 15.

The use of the new form PD-1A is covered by priorities regulation No. 3. The most important feature of the new system of granting individual preference ratings is that these ratings may now be extended to suppliers and sub-suppliers of the original applicant by a simple endorsement on purchase orders.

The Army and Navy are also using a new form of individual preference rating certificate PD-3A assigning ratings to their orders.

PD-1A may not be used to apply for a preference rating on requirements for plant expansion or plant construction; application forms for such requirements (form PD-200) may be obtained from the director of priorities, Washington, D. C., or from any priorities field office.

AUTHORITY ON ATMOSPHERIC POLLUTION DIES

Word has been received of the death on December 6 of Dr. John S. Owens of England, a foremost authority on atmospheric pollution.

Only three days before his death Dr. Owens was awarded a medal by the Royal Meteorological Society for his important work on this subject.

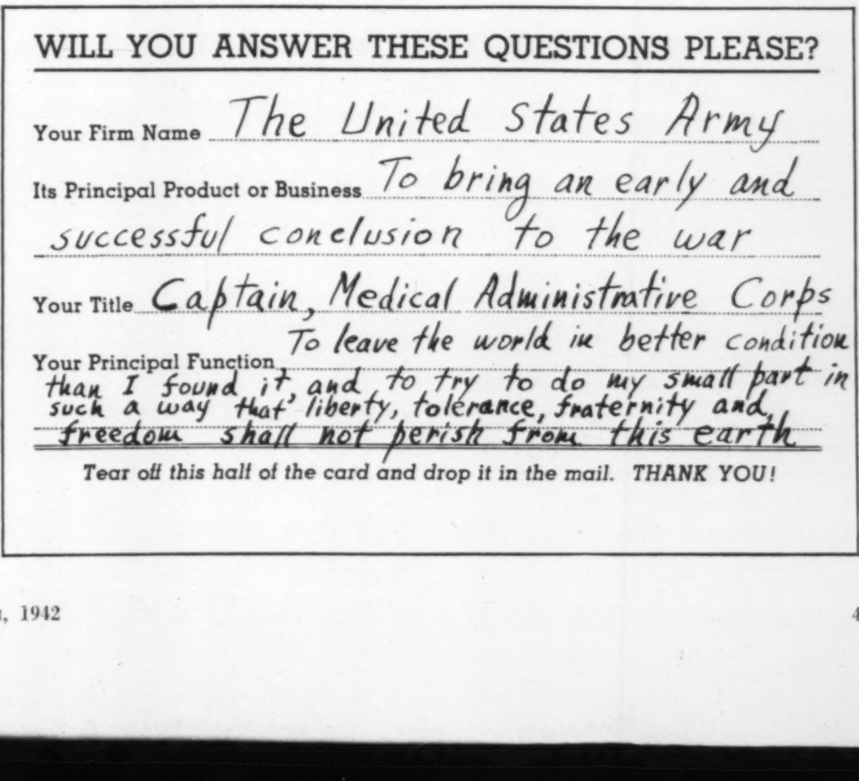
"LIBERTY, TOLERANCE, FRATERNITY AND FREEDOM SHALL NOT PERISH FROM THIS EARTH"

Heating, Piping & Air Conditioning sends a double postcard to each new subscriber, requesting the information about his occupation and business needed in compiling our circulation records.

Captain Willoughby S. Farley, of the Medical Administrative Corps, United States Army, has replied in a well-phrased and most inspiring manner. The "principal product or business" of his employer, he says, is "To bring an early and successful conclusion to the war." In answer to the question "Your principal function?", he writes:

"To leave the world in better condition than I found it, and to try to do my small part in such a way that liberty, tolerance, fraternity and freedom shall not perish from this earth."

Captain Farley's description of his job should be adopted by all of us, whether we serve in our armed forces, in industry or in business.



WILL YOU ANSWER THESE QUESTIONS PLEASE?

Your Firm Name The United States Army

Its Principal Product or Business To bring an early and successful conclusion to the war

Your Title Captain, Medical Administrative Corps

Your Principal Function To leave the world in better condition than I found it, and to try to do my small part in such a way that liberty, tolerance, fraternity and freedom shall not perish from this earth

Tear off this half of the card and drop it in the mail. THANK YOU!

THE EDITOR'S PAGES

Continued

PIPE FITTINGS, HEATING SPECIALTIES SIMPLIFIED

Simplification of pipe fittings was ordered February 25 by the War Production Board in schedule II to limitation order L-42 covering heating and plumbing equipment. Schedule I, issued February 11, required simplification of iron, brass and bronze valves.

The pipe fittings schedule, in its entirety, has already been issued as a simplified practice recommendation by the National Bureau of Standards under No. R135-42. Reduction under this program of the number of fittings in current use from more than 8500 to less than 3000 will satisfy 92 to 94 per cent of all demand, according to the plumbing and heating branch of the WPB. WPB officials said that use of the simplified pipe fittings schedule would release substantial amounts of critical materials which would otherwise be tied up in slow moving stocks.

After March 1, grey cast iron, malleable iron, or brass, or bronze pipe fittings not conforming to the established schedule may not be produced, except with the express permission of the director of industry operations. Provision is made, however, for the delivery of any pipe fittings held in finished form by a producer on March 1, or those which had been processed in such a manner that their manufacture in conformity with the schedule would be impractical.

At a meeting last month called by the plumbing and heating branch of the War Production Board to discuss simplification of vapor and vacuum specialities, manufacturers agreed to simplify the number of sizes of radiator valves, trap bodies and other items in order to save productive capacity and critical materials. The simplification program will probably include the use of cast iron in a number of parts which formerly consumed brass, and elimination of several connecting pieces which allowed for concealed radiation. Army and Navy purchasing agents will soon specify the simplified equipment, it was indicated at the meeting. Terms of the requirements will be issued as a separate schedule to limitation order L-42.

WPB RESTRICTS USE OF GAS FOR HEATING

The WPB issued an order last month which prohibits utility companies selling either natural or mixed natural and manufactured gas for heating buildings, unless the heating equipment was installed before March 1 or was contained in specifications of new buildings under construction on that date. Purpose of the order is to insure adequate supplies of gas for war production, according to the WPB.

REFRIGERATION PIONEER DIES

Ezra Frick, president of the Frick Co. and one of the pioneers in the refrigeration industry, died at his home in Waynesboro, Pa., on February 2, just three weeks after his 86th birthday had been celebrated.

D. Norris Benedict, general manager of Frick Co., has been appointed its president. He has been associated with the firm since 1902.

AMENDMENT TO COPPER ORDER ISSUED

Copper and copper products cannot be sold by mills, warehouses or foundries except on preference ratings of A-10 or higher, according to an amendment to order M-9-a issued February 6 by the War Production Board.

CLARAGE FAN CO. PRESIDENT PASSES ON

Death came to Charles Clarage, president of Clarage Fan Co. on Friday evening, February 6, at his home in Kalamazoo, Mich. Mr. Clarage was born in Kalamazoo August 4, 1860. He is survived by one son, Harry, assistant general manager of the company.

Since 1929, Roland R. Ware has been general manager directly in control of all Clarage operations, which at the present time comprise practically 100 per cent war work.

COAL AND COKE INVENTORY RESTRICTIONS RELAXED

Large users of coal and coke, especially utilities and industrial users, are being urged by the division of industry operations of WPB to build up their inventories as much as possible to avoid the danger of having to suspend operations in case of an emergency.

General inventory order M-97, issued last month, revokes the inventory restrictions imposed by priorities regulation No. 1 insofar as they apply to coal and coke. This order was issued upon recommendation of the Office of the Solid Fuel Coordinator. The order will enable large users to take advantage of the fact that there is at present considerable excess production of coal and coke, and transportation available for distribution of these materials.

NEW PLANNING SECTION IN WPB HEATING BRANCH

Appointment of Ronald Allwork as chief of the new planning and projects section within the plumbing and heating branch of the War Production Board was announced February 20 by W. Walter Timmis, head of the branch. The new section will analyze statistical data affecting the requirements and capacity of the heating and plumbing industry, and maintain close contact on current technical development.

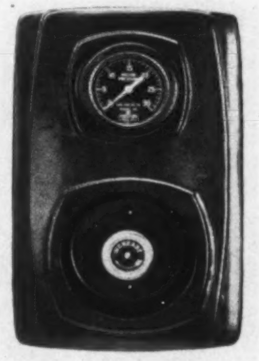
NEW DEFENSE HOUSING CRITICAL LIST ISSUED

A new defense housing critical list has just been issued by the housing priorities branch of the division of industry operations of the WPB, which is more specific than the original one of last September. Among the major changes are that steam or hot water heating systems are allowed only for installations serving two or more families, and that metal jackets for boilers are not allowed. For natural or mixed gas installations, proof of availability of service is required.

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1942, Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

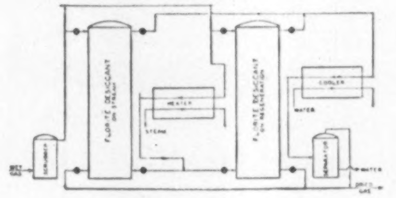
Remote Valve Control Unit

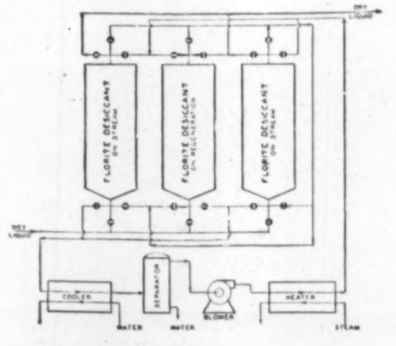


No. 2233—A newly designed unit for the manual control of remote valves, dampers and other pneumatically operated equipment harmonizes in appearance with the rectangular case in which the maker's recording and controlling instruments are now available. When the unit is flush mounted, its front surface is only $\frac{7}{16}$ in. from the surface of the instrument panel, and as its setting knob and pressure indicator are recessed, there are no protruding parts to suffer accidental bumps.

Specifically designed for dead end service, the remote valve control unit will hold reduced pressures, dependably, to values within very narrow limits, it is said. Although most commonly used as its name suggests, it is equally useful in other applications, such as the setting of the control points of distant instruments or the adjustment of positioning or pressure producing pistons, situated in inaccessible points. It is practical for operation over distances as great as 1000 ft.—Foxboro Co., 106 Neponset Ave., Foxboro, Mass.

Drying Agent for Air Conditioning

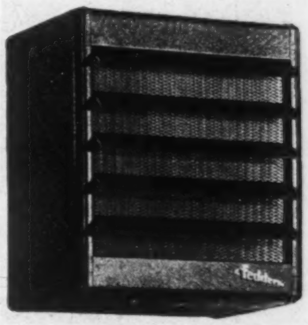

WET GAS
SCRUBBER
FLORITE DESICCANT ON STREAM
HEATER
STEAM
FLORITE DESICCANT ON REGENERATION
COOLER
WATER
SEPARATOR
WATER
DRIED GAS


DRY LIQUID
FLORITE DESICCANT ON STREAM
FLORITE DESICCANT ON REGENERATION
FLORITE DESICCANT ON STREAM
WET LIQUID
COOLER
SEPARATOR
BLOWER
HEATER
WATER
WATER
STEAM

No. 2234**—"Florite" desiccant, a new granular drying agent for gases and liquids, may be used in a variety of industrial processes requiring bone dry gases and liquids. Among the products being successfully dehydrated are natural gas, propane, gasoline, air, nitrogen and carbon dioxide, says its maker. It may also be used in breathers for storage tanks and electrical transformers, to dehumidify air in air conditioning systems and to dehydrate refrigerants. The sketches show dehydration plants for gases (above) and liquids (below).

It adsorbs water instantly and will not swell, disintegrate, or appear wet at the end of an adsorption cycle, according to an announcement which also states that it is hard, stable, non-corrosive and non-poisonous. This desiccant selectively adsorbs 4 to 20 per cent of its weight in water, depending upon the particular application, and is regenerated by heating to 300-350 F.—Floridin Co., Warren, Pa.

Unit Heaters



No. 2235—The new line of "Series 4 Lo-Temp" unit heaters is built in 12 capacities ranging from 75 EDR to 1200 EDR. Capacities are well-graduated to suit requirements economically, states the maker.

Performance characteristics feature low final temperatures combined with large cfm and long range heat distribution. Streamlined tubes and wide blade fans result in quiet operation.

The units are designed to operate on steam pressures up to 150 psi.—Fedders Mfg. Co., Inc., 81 Tonawanda St., Buffalo, N. Y.

For Your Convenience

[3-42]

Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature." (*Circle each number in which you are interested*):

2233	2234	2235	2236	2237	2238	2239	2240	2241	2242
2243	2244	2245	2246	2247	2248				
4110	4111	4112	4113	4114	4115	4116	4117	4118	4119
4120	4121	4122	4123	4124	4125	4126	4127	4128	4129
4130	4131	4132	4133	4134					

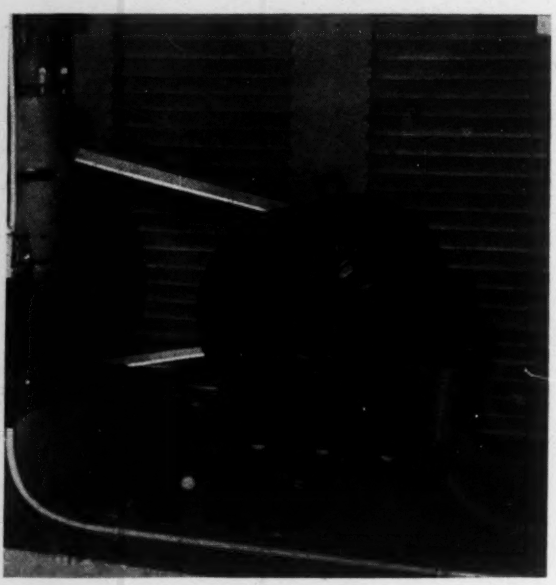
Name.............................. Title.................

Company ....

Address ....

City............................ State..................

INSTALL IT . . .
FORGET IT!



● Tannate-Rockwood installations are giving dependable, trouble-free service on air conditioning drives.

The Tannate-Rockwood drive outpulls and outlasts any ordinary drive, keeps constant speed, maintains uniform machine speed with infrequent attention.

If the load varies, the weight of motor on the pivoted Rockwood base *automatically* adjusts belt tension. Maximum power is transmitted with less wear on belt and bearings.

Where you need a drive you can depend on . . . . use Tannate-Rockwood!

●

J. E. RHOADS & SONS
Established 1702
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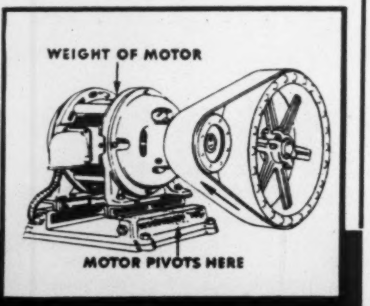
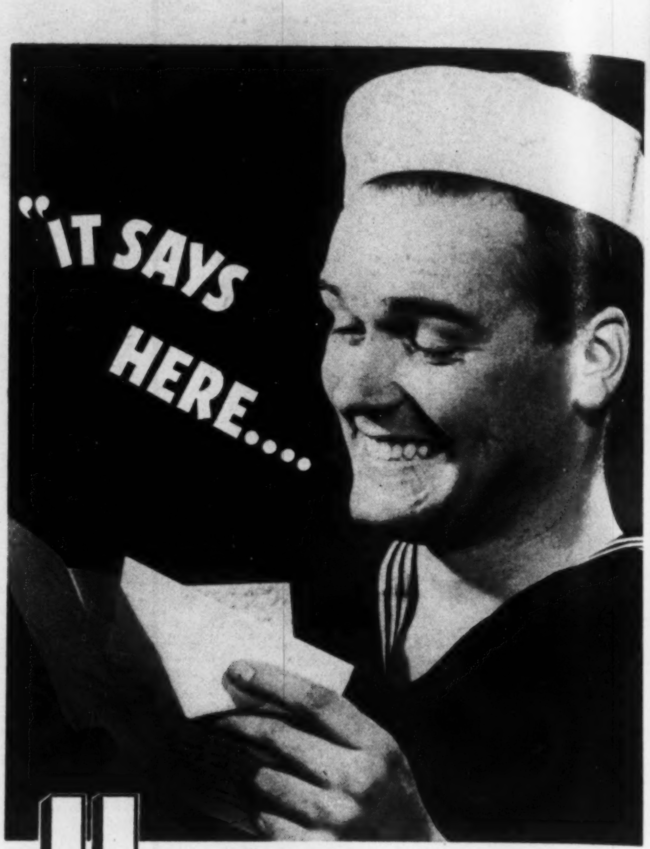


RHOADS

Tannate-Rockwood

The ideal

SHORT CENTER DRIVE


"IT SAYS HERE....

HUSSEY COPPER

IS WORKING NIGHT AND DAY TO HELP US . . .

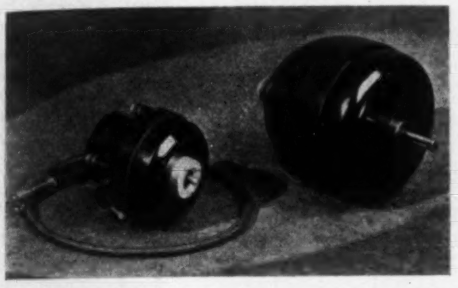
"It's good news to know that the Hussey rolling mills, third largest fabricators of copper sheets in the United States, are working on a war-time basis, too!" It's further assurance that producers of *essential* materials utilizing copper will have an adequate supply for their immediate requirements.

C. G. HUSSEY & CO.
(Division of Copper Range Co., Miners and Refiners of Pure Lake Copper)
Rolling Mills and General Offices: PITTSBURGH, PA.

Warehouses in Principal Cities

New Line of Fan Motors

No. 2236—A new line of unit bearing, shaded pole fan motors for applications requiring a short, quiet, compact motor has been announced. Especially suitable for use with commercial refrigeration, air conditioning, and ventilating systems, these motors are available in three models for 115 volt, 60 cycle operation. "Frame 51AL" operates with or without air over the motor at 1.5 watts, 1550 rpm, and with air over the motor at 3 watts, 1400 rpm. "Frame 51EL" requires air over the motor at 9 watts, 1550 rpm, and operates with or without air over the motor at 3.5 to 6 watts at 1550 rpm. Frame "71GL" is rated 1/40 and 1/25 hp, 1550 rpm, air over the motor, and is for use with direct connected propeller fans only.



Both bearings and motor core are machined in one setup in a single cast member. This assures the uniform air gap and true bearing alignment necessary for quiet operation and uniform, consistent performance, says the maker.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Melting Pots for Soft Metals

No. 2237—The new "Type P Chromalox" melting pots for melting solder, lead, babbitt, tin and type metal (not zinc) are rated from 250 watts to 9000 watts for operation on 115, 230, and 460 volts, single phase alternating current. Melting capacity is from 10 to 920 lb of load depending upon the size of the pot.

The smaller size pots are heated by ring units clamped to the crucible bottom within the insulated jacket. The larger pots incorporate strip heaters clamped to the crucible inside the insulated jacket, providing a maximum safe pot temperature of 900 F.

Heating elements and electrical connections are entirely enclosed within the insulated jacket, assuring safety in handling and leaving the interior of the crucible free of obstructions.—Edwin L. Wiegand Co., 7610 Thomas Blvd., Pittsburgh, Pa.

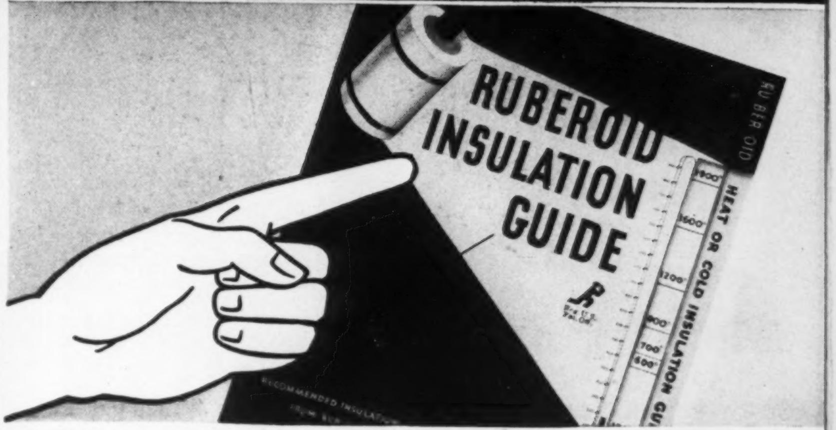
Natural Ventilation in Blackouts

No. 2238—When priorities on basic metals, rubber and copper froze the market for the "Vita-screen" ventilator, steps were at once taken by the manufacturer to adjust his product to the defense plant's need for ven-

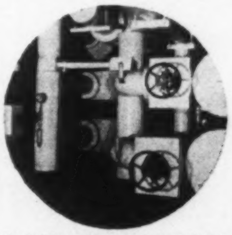
Coca Cola Plant, Baltimore, Md. Insulation used: Carload RU-BER-OID 85% Magnesia Pipe Coverings and Blocks. Also Woolfelt Pipe Covering. *Heating Contractor:* Lloyd E. Mitchell, Inc. *Approved Insulating Contractor:* The Standard Insulation Co. of Maryland, Baltimore, Md.

At your fingertips!

valuable insulation facts in a new FREE guide!



At a glance . . . you learn the proper insulation to solve heat and cold control problems from sub-zero to 1900°F.



MATERIALS, MEN and METHODS . . .

All three contribute to insulation efficiency. The Ruberoid Co. offers you all three to custom-build each insulation job. Should any Ruberoid insulation product be temporarily withdrawn from the market, or priority orders make deliveries long delayed, Ruberoid will suggest other insulating materials that may be substituted without the loss of efficiency.

Offered to you now, in times of national emergency—just when needed most! A FREE Insulation Guide, unlike any ever produced before!

What temperature are you interested in? Quickly, the side index guides you—a flip of the pages—and *that* temperature, and the proper insulation for it, is before you! No wasting time—no reading of many pages! It's there at your fingertips.

More—there are charts and tables, and a vast amount of useful information. All compressed for quick reading.

This valuable Guide shows you how to custom-build each insulation job—reduce heat and power losses and waste of fuel. It shows the complete line of RU-BER-OID Insulation Products—products of a proved merit, high efficiency and a type to meet every need economically.

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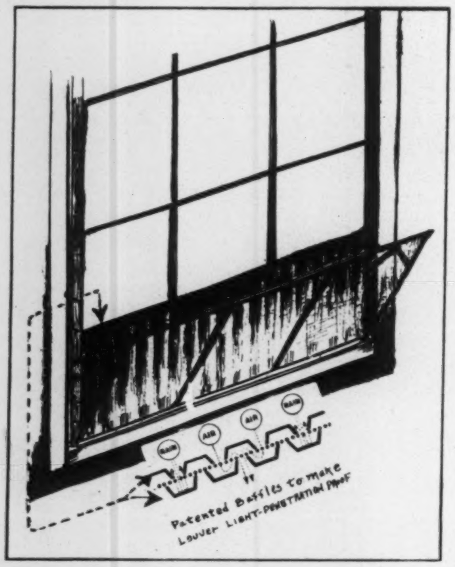
RU-BER-OID

Insulation

For HEATING · COOLING · AIR CONDITIONING

tilation during blackouts. Blacking out of a factory must be done in such manner as to shut off just as little ventilation as possible.

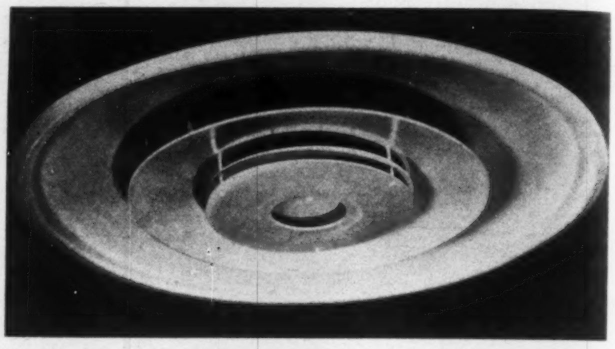
The blackout ventilator is made of heavy gage galvannealed steel sheets or "Armco Paint-grip" sheets, galvanized and rustproofed, and arranged in baffles so as to force the incoming air to turn two corners before entering the room. It is light proof, not even diffused light showing from the outside, and yet at all times the baffles allow a free flow of air inward and outward, the maker states. Between the baffles there is inserted and made an integral part of the ventilator No. 16 mesh wire screening (also painted in British camouflage black). This not only further protects, but aids in keeping out considerable of the dust and dirt. These ventilators or louvers are stormproof and are installed as complete blinds (which may be opened or shut) either on the inside or on the outside of factory sash. In the case of pivot sash the installation is made half in and half out so as to allow freedom of action of the sash itself at all times.



When placed on the inside of windows, as often they are, these ventilators further perform the function of protecting against flying or broken glass.—Vita-Screen Ventilator Co., 103 Park Ave., New York, N. Y.

Adjustable Air Diffuser of Steel

No. *2239*—Besides draftlessly diffusing large volumes of air at high velocities and equalizing room temperature, a unique feature of the "Kno-Draft" ceiling diffuser is its adjustability, the maker says. The entire inner cone assembly may be raised or lowered to vary air direction from vertical to horizontal.



In cooling systems the inner cone assembly is lowered to obtain a horizontal air flow as cool air has a natural tendency to drop of its own accord. In heating systems

"Noiseless"

AIR CONDITIONED COMFORT
at FINKE FURNITURE STORE
because of

Careyduct

THE ALL-ASBESTOS INSULATED DUCT

CONSERVES SHEET METAL for WAR WORK

FINKE'S, at Evansville, Indiana, was the first completely air-conditioned furniture store in this progressive city. Desiring the best in modern air conditioning, the management decided for CAREYDUCT, the all-asbestos duct that combines both duct and insulation in strong, fireproof units.

CAREYDUCT is a natural sound absorber and non-conductor of sound. Outstandingly superior where fan noise, metallic "cracking", or outside noises are objectionable.

Because CAREYDUCT hushes noise, it permits smaller sizes with higher velocities . . . solves many difficult problems where space is limited. Its smooth surface and flush joints reduce friction BELOW that of best metal construction. Eliminates costly shop fabrication; fittings economically made on job.

CAREYDUCT conserves steel for defense purposes. With over 30 important advantages, and saving 6 different labor operations, *CAREYDUCT costs LESS than insulated metal duct.*

Wherever you find management that wants tops in air-conditioning, there's the place to specify a CAREYDUCT job. Write today for all the facts. Build business with CAREYDUCT.

Address Dept. 25.

The Philip Carey Mfg. Company *Dependable Products Since 1873* **Lockland, Cincinnati, Ohio**

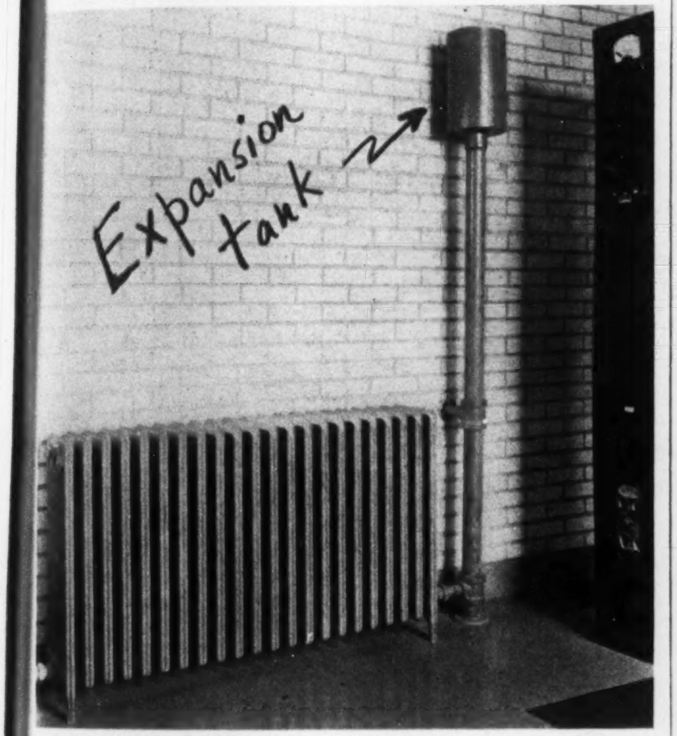
IN CANADA: THE PHILIP CAREY COMPANY, LTD., OFFICE AND FACTORY, LENNOXVILLE, P. Q.

is raised for a vertical air flow, forcing downward the warm air that normally has a tendency to stratify at the ceiling. This feature is said to be particularly advantageous in rooms with high ceilings. Moreover, this adjustable feature frequently means that the units may be regulated to suit individual job conditions.

Formerly fabricated of spun aluminum, these diffusers are now made of steel. They may be obtained in a unit combining diffused supply air and return or exhaust in one terminal. They are also available with built-in direct or indirect lighting.—W. B. Connor Engineering Corp., Dorex Div., 114 E. 32nd St., New York, N. Y.

Electric Heat Solves Problem

No. 2240—Electric heat was the answer to a heating problem recently presented at the Bayport station of the South Bay Consolidated Water Co., Bayport, L. I. This pumping station contains two rooms on the ground floor, and a basement. One of the two ground floor rooms serves as an office, and the other is the chemical feeder room, separated from the first by a brick partition.

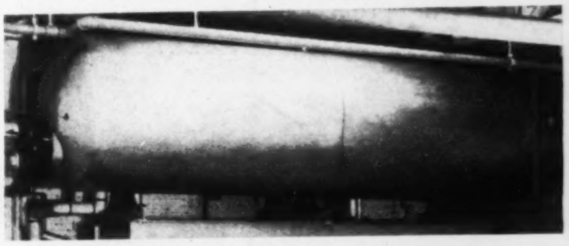


Since the chemicals stored in this second room are of a nature to attack almost any metal except cast iron, it was decided that the best method of heating the room would be by using cast iron radiators. It was decided to build an electric immersion heater unit in the basement to supply hot water to the radiators in both first floor rooms.

Three electric water immersion heaters are used to heat the water. The hot water riser leads from the top of the three heater enclosing pipes to the radiators on the main floor. The returns lead back to the bottom of the heater, providing a neat, compact circulating system. A magnetic contactor handles the heater load, and is controlled by a thermostat placed in the operating room above.

An expansion tank is connected to each of the

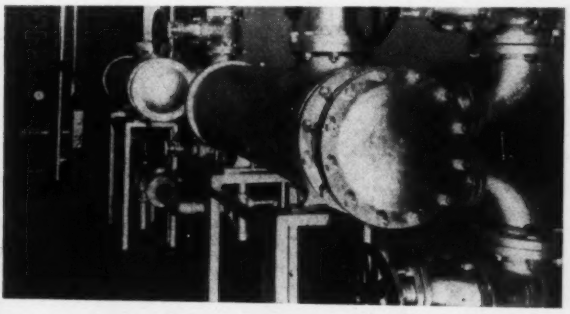
WHITLOCK



• WRITE FOR BULLETIN 40 •

STORAGE WATER HEATERS

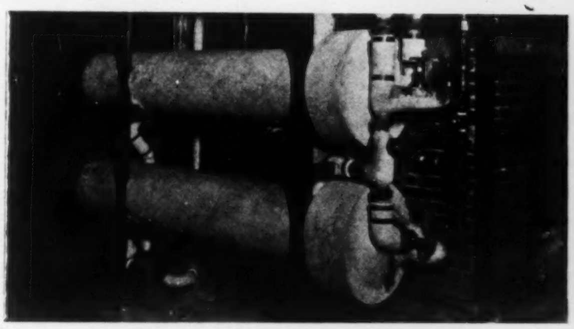
Whitlock Type K Heaters are found wherever hot water is used in large quantities—industrial plants, institutions, hotels, and laundries. Specified by leading engineers.



• WRITE FOR BULLETIN 20 •

INSTANTANEOUS HEATERS

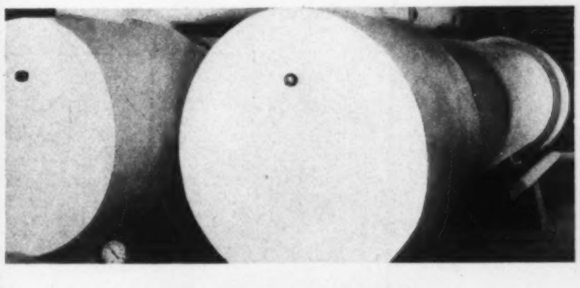
Straight tube, U-tube, and coil tube designs. Heating water for storage; for heating systems (convertors); and other uses requiring hot water at a uniform rate.



• WRITE FOR BULLETIN 31 •

FUEL OIL HEATERS

Preheating fuel oil reduces viscosity, improves atomization, raises efficiency. Service records at hundreds of plants endorse Whitlock Fuel Oil Heaters. Straight, U-, and coil tube designs.



• WRITE FOR FULL INFORMATION •

WATER CHILLERS

For use with Freon, Methyl Chloride, and Sulphur Dioxide are good examples of Whitlock Heat Exchangers for air conditioning service. Variety of designs available.

Send complete information if quotation is desired.

THE WHITLOCK MANUFACTURING COMPANY

44 South Street, Elmwood, Hartford, Connecticut
District Offices in New York, Boston, Chicago, Philadelphia, Detroit, Richmond

★ ★ ★

3 WAY DEFENSE!

1- *Asbestos Protected* DUX-SULATION

A flexible insulating blanket ½" thick having a K factor .27 B.t.u. Comes complete with corner tape and adhesive for cementing on to sheet metal duct work. Dux-Sulation comes 36" wide in a roll containing 100 square feet. Easy to apply and a very efficient insulation against temperature losses, condensation and noise travel. Will not rot, chip or crack.

2-A·R·A·SHEETS

An Asbestos-Clad Insulating Board for forming cold air returns, ventilating and air conditioning ducts, casings, cabinets, etc. A.R.A. is a strong board about 3/16" thick, having a K factor of .45 B.t.u., and a Mullen test of over 200 lbs. per square foot. Standard sheet size 33" x 48".

3-ASBESTOS FLEXIBLE DUCT CONNECTION

An Asbestos Woven Fabric for making a tight, fire-safe, permanent joint between metal duct sections to absorb vibrations and sound travel. Comes in a roll 6" wide, 50 feet long with salveged edges. Can be screwed, clamped or bolted into place.

Write for Samples and Information

GRANT WILSON INC

4101 WEST TAYLOR ST., CHICAGO, ILL.

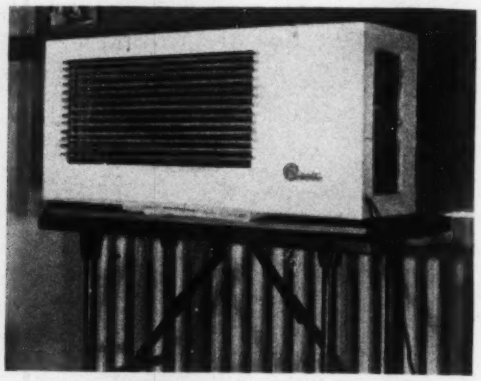
★ ★ ★

radiators in the first floor rooms. The radiator capacity is so arranged that the expansion tank can take care of the water expansion under any operating condition.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Window Ventilator Unit

No. 2241—A manufacturer of window type room coolers has announced a new "blackout" machine.

The new unit is a ventilating device in a cabinet which will house the refrigeration equipment at a later date. It brings in filtered outside air, cleans room air and exhausts stale air simultaneously, if desired. It fits in the window with plywood wings filling in the additional space on either side of the unit. The machine is 28 in. wide and 14½ in. deep. Covered in a simulated leather, it makes an attractive installation.

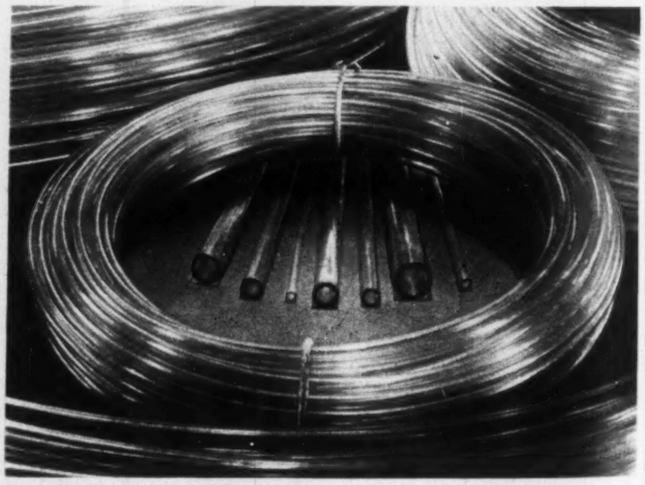


The refrigeration equipment which later can be installed in the cabinet will be rated at ½ hp.—Pleasantaire Corp., Tower Bldg., Washington, D. C.

Transparent Plastic Tubing

No. 2242**—Transparent "Tenite" tubing in sizes ranging from $\frac{3}{16}$ to ¾ in. in diameter is now available. It is a seamless tubing extruded in continuous lengths.

This new plastic tubing is virtually unbreakable and may be readily bent, formed or curved to fit almost any condition, the manufacturer states. The ends may be easily adjusted to standard flared fittings with the same tools that are used for copper tubing. Large diameter tubing, with a wall thickness of 0.0625 in., can be threaded with standard thread cutting tools.



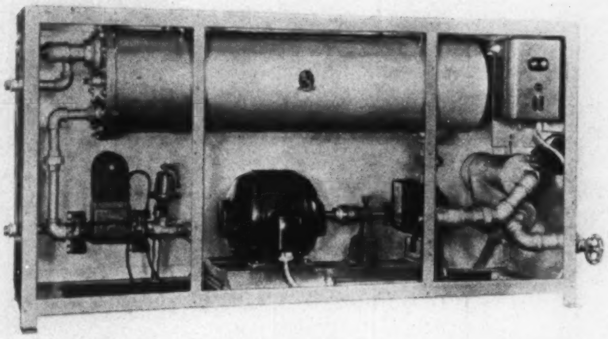
Tubing in sizes up to ½ in. diameter, with a wall thickness of 0.035 in., is stocked in long length coils such as are shown in the illustration. Tubing over ½ in. diameter is stocked in 12 ft lengths. One inch diameter tubing is expected to be available shortly.

This transparent tubing is extruded by Extruded Plastics, Inc., Norwalk, Conn., from a cellulose acetate butyrate formula of "Tenite," produced by Tennessee Eastman Corp., Kingsport, Tenn. The tubing is distributed by Julius Blum & Co., Inc., 532 West 22nd St., New York, N. Y.

Oil Coolers

No. 2243—Offered to meet current needs for accurate control equipment for heat treating processes is a complete line of rapid oil coolers. These coolers are used to maintain a constant temperature in the oil quench bath, a necessity in producing uniform quality in heat treated metals.

The illustration shows the "B & G" self-contained oil cooler, a unit which combines all necessary equipment, except the quench tank, in a single, compact package.

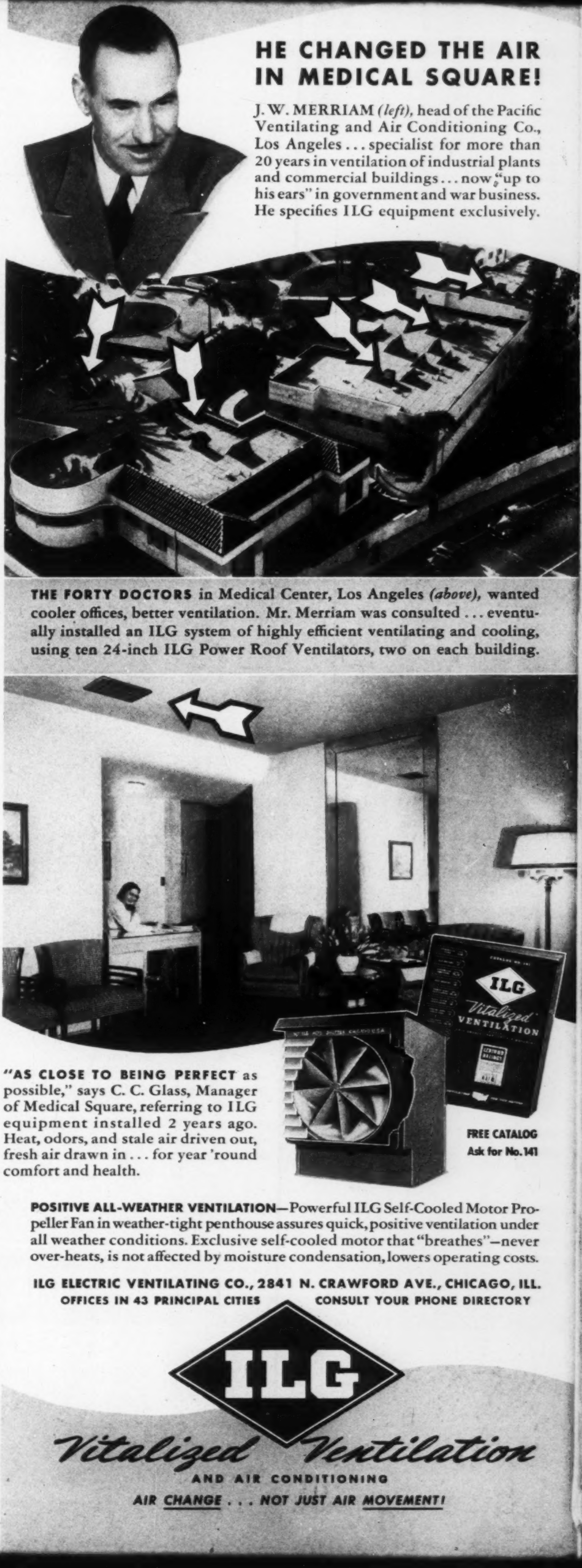


The manufacturer offers a complete engineering service in connection with the design and installation of complete oil cooling systems. This is calculated to relieve part of the pressure on plant engineers and conserve their time for strictly production problems.—Bell & Gossett Co., Morton Grove, Ill.

Cement for Laying Firebrick

No. 2244—A new cement for use in laying insulating firebrick provides improved workability, greater coverage, a high degree of cold bonding strength and hot bonding strength, the maker says. It provides a coefficient of expansion of the dried cement virtually the same as the brick with which it is used, eliminating cracking and peeling caused by differential expansion.

This "No. 2500" cement provides an excellent bond of moderate strength without possessing the bonding characteristics of an "air set" cement, it is pointed out by the maker. It is particularly suitable for use directly exposed to furnace temperatures over 1800 F. Because a "fired bond" is not attained at lower temperatures, back up brick which are laid with the new cement can readily be salvaged with little or no loss.—Armstrong Cork Co., 994 Concord St., Lancaster, Pa.



HE CHANGED THE AIR IN MEDICAL SQUARE!

J. W. MERRIAM *(left)*, head of the Pacific Ventilating and Air Conditioning Co., Los Angeles . . . specialist for more than 20 years in ventilation of industrial plants and commercial buildings . . . now "up to his ears" in government and war business. He specifies ILG equipment exclusively.

THE FORTY DOCTORS in Medical Center, Los Angeles *(above)*, wanted cooler offices, better ventilation. Mr. Merriam was consulted . . . eventually installed an ILG system of highly efficient ventilating and cooling, using ten 24-inch ILG Power Roof Ventilators, two on each building.

"AS CLOSE TO BEING PERFECT as possible," says C. C. Glass, Manager of Medical Square, referring to ILG equipment installed 2 years ago. Heat, odors, and stale air driven out, fresh air drawn in . . . for year 'round comfort and health.

FREE CATALOG
Ask for No. 141

POSITIVE ALL-WEATHER VENTILATION—Powerful ILG Self-Cooled Motor Propeller Fan in weather-tight penthouse assures quick, positive ventilation under all weather conditions. Exclusive self-cooled motor that "breathes"—never over-heats, is not affected by moisture condensation, lowers operating costs.

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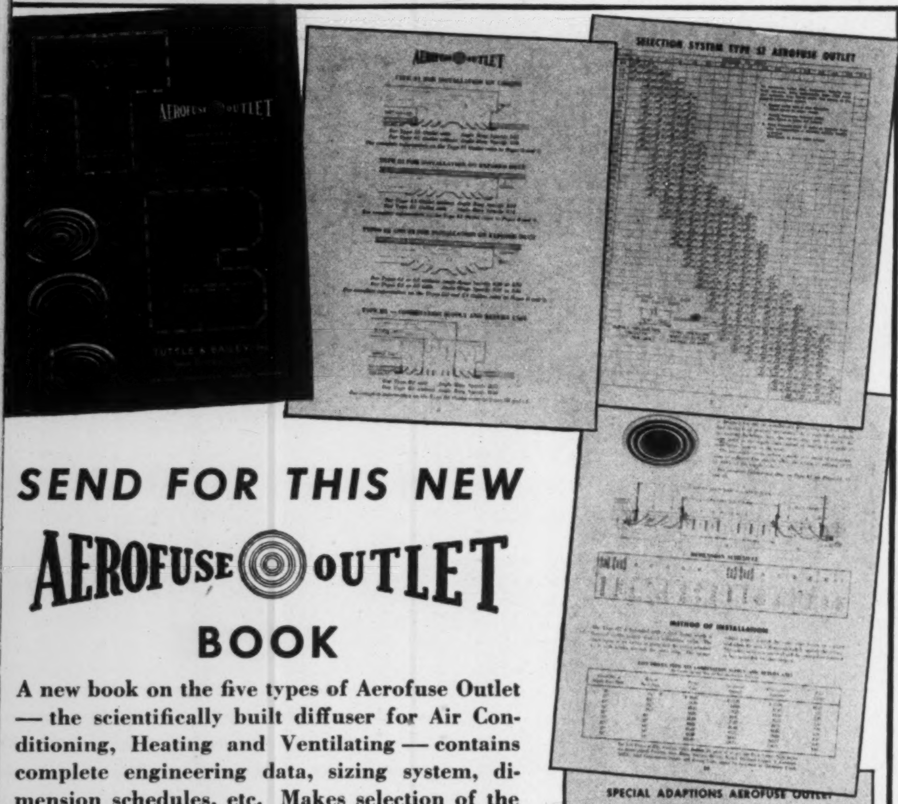
OFFICES IN 43 PRINCIPAL CITIES CONSULT YOUR PHONE DIRECTORY

ILG

Vitalized Ventilation

AND AIR CONDITIONING

AIR CHANGE . . . NOT JUST AIR MOVEMENT!



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BOOK

A new book on the five types of Aerofuse Outlet — the scientifically built diffuser for Air Conditioning, Heating and Ventilating — contains complete engineering data, sizing system, dimension schedules, etc. Makes selection of the proper unit for the job quick and convenient. Send for your copy at once.

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NEW YORK **CHICAGO** **PHILADELPHIA** **HOUSTON**

Acquires Pump Company

No. 2245—Pomona Pump Co., manufactur of vertical pumps, has announced the purchase the Westco Pump Div. of Micro-Westco., Inc Bettendorf, Iowa.

The newly acquired business will be operate as Pomona Pump Co., Westco Div., 2621 Locu St., St. Louis, Mo., and manufacture continue from the St. Louis plant of the Pomona Pump C Management and key personnel of Westco will transferred to St. Louis.

Cement-Asbestos Pipe

No. 2246*—"Roxite" is the trade name of a new line of cement-asbestos pipe which is of high density and mechanical strength, according to the manufacturer. Patented "Flexlock" sleeves and fittings are used to couple the pipe, no special tools being necessary for assembling. Special treatment or threading of the pipe ends is not required.

This pipe has been developed to handle a wide range of mildly corrosive solutions, for transporting processing water which must be kept free of metallic contamination, etc. It may also be used for handling fumes and gases in ventilating ducts and stacks. For more severe duty, the pipe is available with an impregnated or synthetic coating of several types, depending upon the required service.

Available in any length up to 14 ft, standard sizes range from ¾ to 8 in. internal diameter Ten and 12 in. sizes may be had on special order A complete line of standard fittings may be had This pipe is satisfactory for working pressures up to 150 psi, it is stated.—United States Stoneware Co., 60 E. 42nd St., New York, N. Y.

Airplane Heating Controls

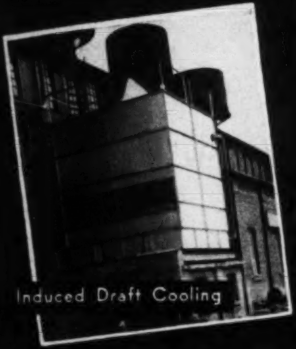
No. 2247—Announcement has been made by W. A. Ray, president of General Controls Co., Glendale, Calif., of the acquisition of the Cunningham Controls Co., Burbank, Calif. For several years, Cunningham has engaged in the manufacture of temperature controls for installation on transport planes, specializing in all forms of temperature control systems with particular emphasis directed toward airplane cabin heating controls.

Completes Line of Valves and Fittings

No. 2248*—The Schaible Foundry and Brass Works Co., 1086 Summer St., Cincinnati, Ohio, has just announced acquisition of the complete line of "Kelly" automatic steam, air and vacuum valves, and the line of "Eureka" low pressure valves and fittings for heating and plumbing. Until present inventory stocks are exhausted, there is to be no change in either of these trade names.

These products were formerly manufactured by a division of the National Metal Products Corp. and a division of the Ohio Pattern Works & Foundry Co., respectively.

There's a BINKS cooling tower for every air-conditioning job



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Natural Draft Cooling

Rotojet Spray Nozzles

Indoor Installations

Outdoor Installations

BINKS cooling towers are designed to cut down water bills and reduce operating costs of modern air conditioning equipment. Each tower is tailor made for the particular job in hand. The towers are light in weight, adaptable to small areas and quiet in operation. BINKS ROTOJET spray nozzles break the water into an exceptionally fine mist for maximum cooling. Drift moisture is reduced to a negligible factor. In BINKS cooling towers both the first cost and operating costs are low. BINKS cooling towers are made in all sizes and types—forced draft or natural draft—for use indoors or outdoors.

WRITE TODAY for your copy of BINKS latest water cooling catalog and data book. No obligation.

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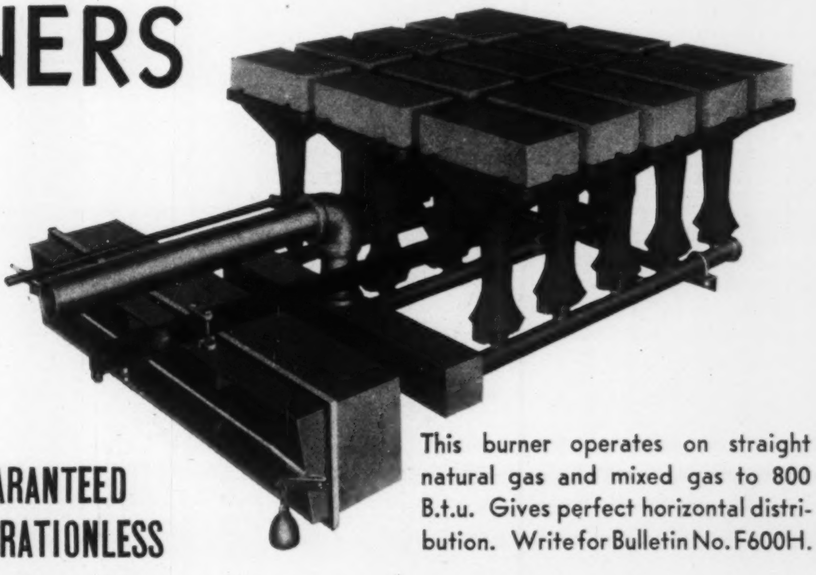
WECO - N. G. E. Series F600
GAS BURNERS

These burners are available for ratings from 50,000 to 10,000,000 B. t. u. output, for use in heating boilers, power boilers—in any metal firebox or sectional boiler. Featuring flexibility to meet various firebox shapes and sizes at various gas pressures, and low draft loss. Full automatic controls that operate properly can be easily applied.



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This burner operates on straight natural gas and mixed gas to 800 B.t.u. Gives perfect horizontal distribution. Write for Bulletin No. F600H.

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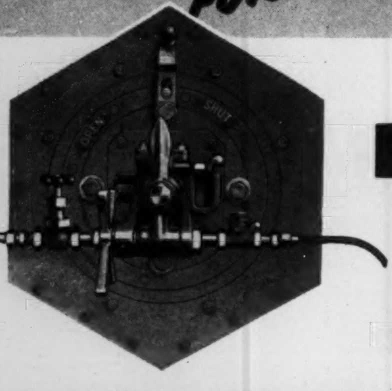
Surface Combustion Corp. . . . . Toledo, Ohio



PEAK POWER-PLANT EFFICIENCY-- FOR THE WAR EFFORT!

TODD COMBUSTION UNITS

POWER COUNTS—today as never before! Super-efficient, economical Power. Upping production to unheard-of levels—driving ships at sea—speeding the Victory!

Whatever your share in the War Effort, whatever the size of your plant, a Todd unit, burning liquid or gaseous fuel, can help you get maximum heat and power production, accelerate your whole operation, keep maintenance costs right down to minimum.

Throughout the Nation, in a wide variety of plants producing the War Effort, Todd products including rotary burners and the famous "VEE-CEE"—with its exclusive "variable range" feature—are today turning in enviable records for achievement. Efficiency, economy, ease of operation and **first-class performance** are always assured—each installation is **individually engineered** to do an outstanding job!

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For your convenience in obtaining copies of these bulletins, see coupon on page 119. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to HEATING, PIPING & AIR CONDITIONING.

Air Conditioning and Heating

No. 4110—12 p. condensed catalog (AC-152) covering air conditioning, refrigeration and space heating equipment, with information on self-contained air conditioners, dehydration equipment, equipment for refrigeration and low temperature air conditioning, and industrial and commercial heating apparatus. Centrifugal refrigeration machines are also covered.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Air Conditioning for War

No. 4111—24 p. annual report of Carrier Corp., of general interest as it indicates that industries are turning more and more to air conditioning and refrigeration equipment as tools to speed vital war production. Among such uses are air conditioning equipment for blast furnaces, resulting in greater pig iron capacity; cooling and air conditioning for deep copper mines; dehumidifiers for storage of parachutes; equipment for control of temperatures in mass production of precision instruments; air conditioning equipment for blackout plants; and others.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Asbestos Return Air Sheets

No. 4112—16 p. booklet briefly describing and illustrating with cartoons the features of "ARA" asbestos return air sheets for duct construction.—Grant Wilson, Inc., 4115 W. Taylor St., Chicago, Ill.

Commutator Cleaning Stone

No. 4113—6 p. bulletin describing new commutator cleaning stone for removing excess film and brush deposits from motors and generators "right on the job", without taking machine out of service.—Ideal Commutator Dresser Co., 1096 Park Ave., Sycamore, Ill.

Controls for Industry

No. 4114—Controls for industry folder (F-1695) containing condensed data sheets describing motor operated valves for steam, air, oil, gas, water and other fluids; control motors for use as damper operators and power units; thermostats for room, duct and immersion applications; program controllers for sequence operations; and electric controls for industrial applications such as dryers, hot water storage tanks, proof boxes, etc.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Copper Tubes for Industrial Applications

No. 4115—64 p. booklet (C-24) on "Anaconda" copper tubes for industrial applications, including sugges-

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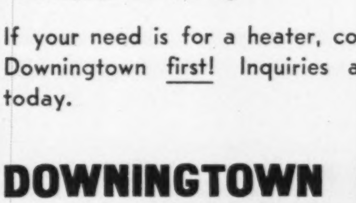

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tions for assembling, with extensive information on advantages, threadless connections, fittings, accessories, flow of water, friction loss, heat losses, etc. Among the services for which the tubing is used are refrigeration and air conditioning, hot and cold water, space heating, and conveying numerous process materials. This copper tubing can, of course, be supplied only when acceptable priorities are forthcoming from the purchaser.—American Brass Co., 414 Meadow St., Waterbury, Conn.

Covers for Bearings

No. 4116—4 p. bulletin (11-C) on standard covers for ball and roller bearings, containing detail drawings, information on sizes and styles, and featuring advantages. —R-S Products Corp., Germantown Ave. at Wayne Junction, Philadelphia, Pa.

Expansion Joints

No. 4117—14 p. bulletin (35-15B) on "Adsco" piston ring type expansion joints which can be unpacked and repacked under full operating pressure. Details of construction, dimensions, specifications, etc., are given on this joint, which is made in sizes from 2 to 20 in. for all pressures up to 400 psi.—American District Steam Co., Bryant St., North Tonawanda, N. Y.

Gages

No. 4118—65 p. catalog (1000) on gages containing listings and descriptions of numerous types, streamline cases, gages for special services and a complete listing of "Duragauges". In addition, gage testers and accessories required by users are illustrated.—Ashcroft Gauge Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Glass and Its Adaptabilities

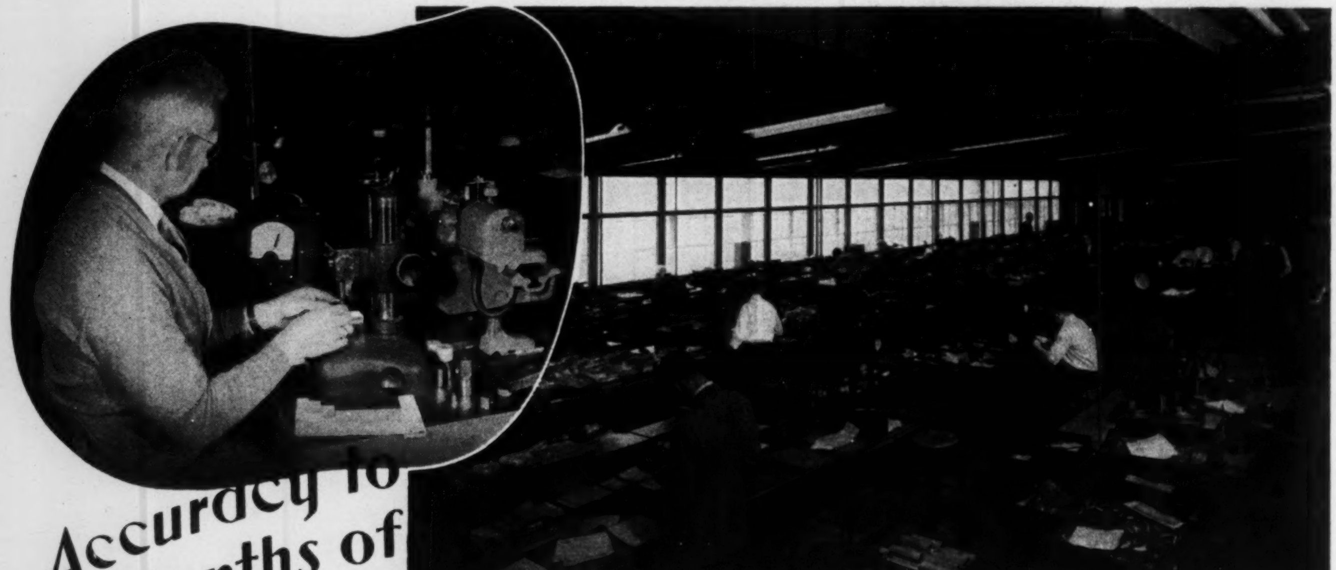
No. 4119—32 p. brochure on glass and its adaptability to modern needs, listing the manufacturer's flat glass products, physical and engineering properties, and suggested applications. One purpose in issuing this booklet is "to put before engineers in various industries the availability and characteristics of flat glass products with the hope they may serve in certain applications to take the place of strategic metals." Information is included on heat absorbing glass.—Pittsburgh Plate Glass Co., 2000 Grant Bldg., Pittsburgh, Pa.

Heat Insulation Handbook

No. 4120—176 p. heat insulation handbook, designed for ready reference and including a comprehensive insulation recommendation section illustrated with over 90 drawings and photographs of application details. There is also a data section containing 24 pp. of engineering tables, graphs and definitions of technical terms.—Ehret Magnesia Mfg. Co., Valley Forge, Pa.

Industrial Products

No. 4121—52 p. industrial products catalog (Form GI-6A), including recommendations on the use of insu-



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These three advantages make ADSCO-Bannon Tile Conduit a big favorite for the steam and hot water lines of army camps — naval and air bases, defense plants and housing projects.

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lations and refractories for various services and data on "Transite" asbestos cement pipe, friction materials, electrical materials, packings and other products. — Johns-Manville, 22 E. 40th St., New York, N. Y.

Priorities and Pyrometers

No. 4122—6 p. bulletin explaining how war production program affects purchase, use and maintenance of temperature measuring and control instruments, issued "to aid industrial instrument users to gain maximum life and efficiency from pyrometric equipment now installed or being installed."—Wheelco Instruments Co., 1933 S. Halsted St., Chicago, Ill.

Refrigeration Equipment

No. 4123—Looseleaf catalog on refrigeration compressors, giving detailed information, illustrations and specifications for various models together with capacity ratings.—Diceler Corp., Greenville, Pa.

Rotary Switches

No. 4124—16 p. catalog (7140) on rotary switches illustrating and describing features and with diagrams of connections. Faceplate markings for each switch are indicated and there are illustrations of all standard faceplates.—Roller-Smith Co., Bethlehem, Pa.

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No. 4125—8 p. bulletin (450) on float-thermostatic steam traps, compressed air traps and liquid level con-

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trols. Descriptions, dimensions and diagrams—as well as price lists—are included, and capacity tables are presented. Piping details are shown.—Sarco Co., Inc., 475 Fifth Ave., New York, N. Y.

Steam Turbines

No. 4126—6 p. bulletin (1951) on steam turbines with combined reduction gears illustrating and describing features in detail, and giving table of dimensions. Also, 6 p. bulletin (1955) on multistage steam turbines available for condensing or noncondensing operation and in the number of stages as required for best economy.—Moore Steam Turbine Div., Worthington Pump & Machinery Corp., Wellsville, N. Y.

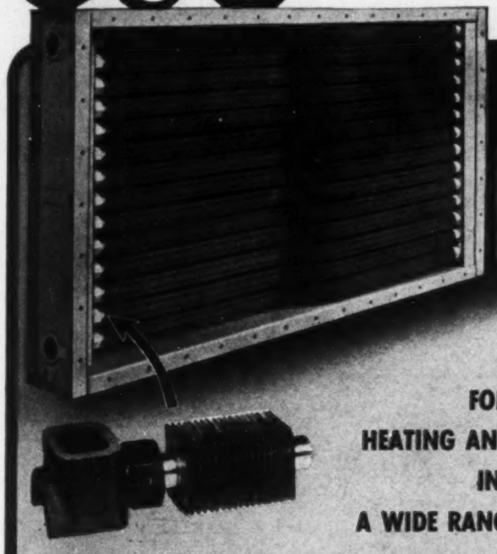
Underground Steam Line Construction

No. 4127—Bulletin (420A) presenting practical engineering data on underground steam systems, compiled from field experience and pertaining specifically to war construction program. A reference manual designed to be of practical assistance to those concerned with layout and purchase of underground and overhead steam lines, the book covers general requirements for average needs on underground heating or power piping systems, with typical layouts, sketches, diagrams and plot plans of actual installations.—Ric-wiL Co., 1563 Union Trust Bldg., Cleveland, Ohio.

Unit Coolers

No. 4128—4 p. bulletin announcing that limited quantities of the manufacturer's unit coolers are available.

G&O COILS



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Float and Thermostatic Trap

Why use expensive, "bulky" Float and Thermostatic Traps on your Unit Heater installation, when the compact, quick operating Sterling No. 69 F & T Trap will do the job! Weighs only 7 pounds, measures 3 x 5 x 5 inches—yet handles over 1300 lbs. of condensate per hour at 20 lbs. pressure.

Saves on piping and installation time by providing four methods of connection—with two steam inlets, two return outlets. Easy to clean—without disturbing piping—by merely removing four capscrews.

Use this compact, efficient trap on the numerous installations that its high capacity permits. Its unobtrusive size will improve the neatness of the entire Unit Heater installation; and will offer you remarkable savings in initial cost and maintenance.

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One of the two Empire State Express Super - streamliners conceded to be the world's finest day trains, costing almost $2,500,000.00 to build. Equipment of the luxurious cars includes summer and winter air conditioning with capacity for complete change of air in each car in four to six minutes. The filters are AIR-MAZE.

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Car maintenance shops along the route are provided with duplicate spare sets of AIR-MAZE filter panels so that while one set is in operation, another is being cleaned and prepared for further service. Thus, these twin super-streamliners are always assured top notch filter performance with minimum effort and loss of time.

This outstanding recognition of AIR-MAZE advantages is further evidence of the complete adaptability of these permanent air filters to every air conditioning requirement.

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DEPENDABLE AIR FILTERS FOR EVERY APPLICATION

illustrating and briefly describing them.—Fedders Mfg. Co., Inc., 81 Tonawanda St., Buffalo, N. Y.

Unit Heaters

No. 4129—4 p. bulletin (46S-3) on five-way unit heaters which distribute air in four directions and downward and are available in a wide range of sizes and capacities.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Variable Pitch Speed Changers

No. 4130—20 p. bulletin (B6013A) illustrating and describing the "Vari-pitch" speed changer with diagrams, operating data and selection tables for units handling from 1½ to 75 hp. With these units speed variations are readily available in a range of 375 per cent.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

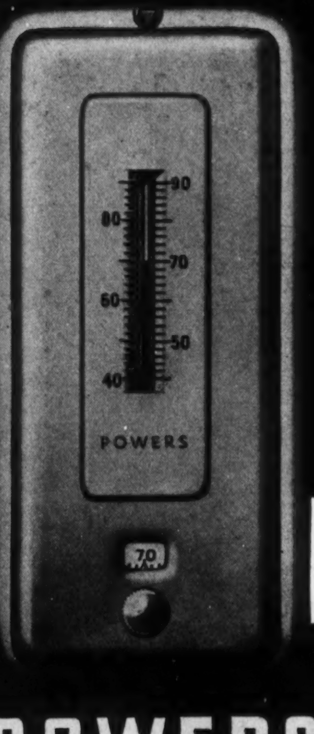
Variable Speed Control

No. 4131—52 p. catalog and handbook on variable speed control, covering variable speed pulleys, variable speed transmissions, automatic tension control motor bases, etc. Information on sizes, capacities, design and operating details, applications and installation methods included.—Ideal Commutator Dresser Co., 1096 Park Ave., Sycamore, Ill.

V Belts

No. 4132—Issue of Texrope Topics (Vol. 12, No. 1) with interesting information and illustrations on various

GRADUAL
CONTROL
has been an outstanding feature of Powers regulation since 1891. With this type of control, valves or dampers are opened or closed **gradually,** which results in exceedingly close regulation and the maximum of comfort obtainable with automatic control.



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WRITE FOR BULLETIN NO. 200

POWERS TEMPERATURE *and* HUMIDITY CONTROL

applications of v belt drives, including their use in connection with the air conditioning of windowless mushroom growing houses. Air is furnished the growing houses by two 56,000 cfm blowers driven with "Super-7" v belts.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Welders

No. 4133—20 p. bulletin on the "Shield-Arc" welder with self-indicating dual continuous control, explaining how this control varies the type and size of the welding arc and its advantages in improving welding technique. Various features of the welders are described and illustrated and types of machines available are illustrated. —Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

Wrought Iron and Steel

No. 4134—62 p. general catalog on wrought iron tubular and hot rolled products, steel tubular products and alloy steels. One reason for issuing this catalog is, according to the manufacturer, "to avoid having old customers who are helping in the war production program to seek substitutes unnecessarily for such products as long as he has need for them and the government approval which enables that need to be satisfied." Extensive and detailed data are included on wrought iron and steel. There is a practical section on specifications with a number of references, a presentation of general notes on mill standards, instructions for ordering, identifying markings, tables of dimensions, weights and sizes, bundling schedules for pipe, tables of rolling limits, and a treatment of many other subjects of interest.—A. M. Byers Co., Clark Bldg., Pittsburgh, Pa.

LOOK

for the DARTS

you thought were through

And put them back to work

We are recommending to plants all over the country, that they make a search to locate used and discarded Dart Unions, so that they can be *put back on the job.*

You see, Dart Unions are engineered and made to be used again, again and again . . . providing "first-time" tightness each time they are installed. Matched bronze seats, ground to accurate "true-ball" surfaces is one important reason why Dart Unions can do this. *Another* reason is that Dart Bodies and Nuts are made of air refined malleable iron that resists pipe strains, rust and rough handling.

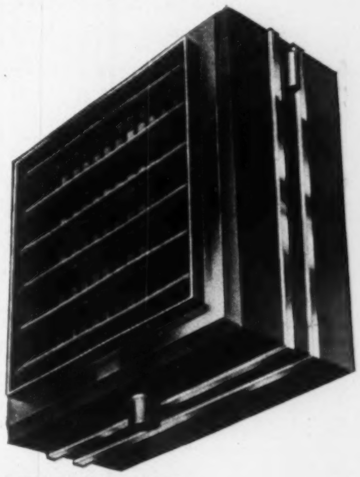
See your *supplier* for new Darts. For remember old or new a Dart comes through.

DART
UNIONS
E. M. DART MFG. CO., PROVIDENCE, R. I.
SALES AGENTS: THE FAIRBANKS COMPANY, NEW YORK AND ALL BRANCHES
CANADIAN FACTORY: DART UNION COMPANY LTD. TORONTO CANADA

WE CAN DELIVER

within a reasonably short time

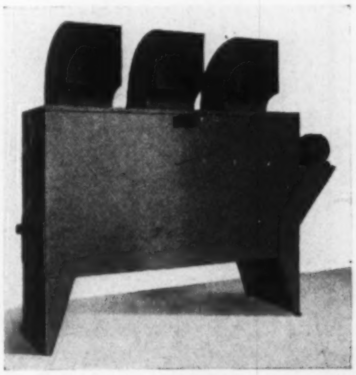
Our unit heaters are equipped with ALL STEEL Heating Elements. We have always standardized on ALL STEEL Elements, and therefore do not need to change our methods in spite of the war. Many years of experience and research are built into every model. Hundreds of American factories are efficiently heated by Airtherm Unit Heaters.



The AIRVECTOR

Propellor Fan Type Unit Heater

For floor and ceiling mounting, makes a highly efficient installation. Rugged construction. All-welded joints. Available in a complete range of sizes for any job. Quiet and efficient operation. Good heat distribution over large area.



The AIRHEATOR

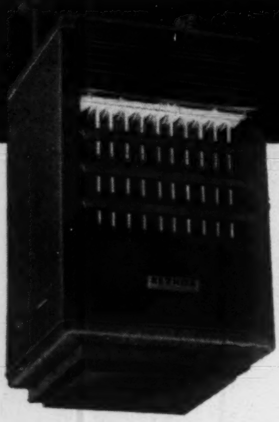
Centrifugal Fan Type Unit Heater

With many exclusive features in design and construction. Great resistance to corrosion, pressure and temperature. Airvector Unit Heaters have Ribbed Cabinets, greater rigidity, and eliminate vibration and "sounding board" action. Models are mounted with four-point saddle type suspension. Complete range of sizes for any job.

Write today for information.

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. ST. LOUIS, MO.

SPEEDS "ALL OUT" PRODUCTION FOR 3 REASONS . . . .



1. QUICKLY INSTALLED
2. SAVES FLOOR SPACE . . . .
3. MORE HEAT OVER WIDER AREAS . . .

REZNOR *Gas Unit Heaters*

Compared with other systems, Reznor suspended gas unit heaters require only a fraction of the usual time and material for installation, thereby saving $1.50 to $2.00 per square foot of radiation. Special heat exchanger tubes permit them to move more air over wider areas. Write today for Reznor's catalog showing 3 types and a complete range of sizes.

REZNOR MANUFACTURING COMPANY
305 JAMES STREET MERCER, PENNA.
"GAS HEATERS EXCLUSIVELY SINCE 1888"

SC
Kathabar
CONTROLLED ATMOSPHERES
GIVE YOU

Measured HUMIDITY

FOR PROCESSING OR COMFORT

● More and more Kathabar Systems are selected for "difficult" industrial processing jobs and *chill, shock* and *clamminess-free* comfort applications. Why? Because today's needs are for more, better and faster production. You can maintain your volume, organization and profits by specifying and installing Kathabar in '42.

If you want to know how—'phone, write or wire for a Kathabar representative.

SURFACE COMBUSTION
TOLEDO, OHIO

Useful Information

How to Go After War Work

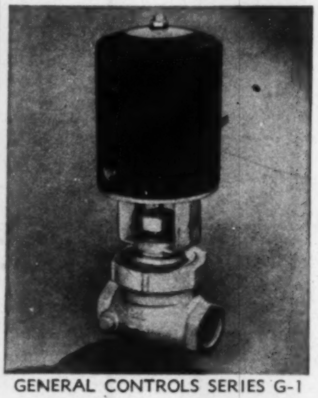
How Small Industries Can Go After War Work is the title of an illustrated booklet published by the Copper & Brass Research Association, 420 Lexington Ave., New York, N. Y. Purpose of the booklet is to show small companies how to go after contracts or subcontracts through the contract distribution branch, production division, War Production Board, Washington, D. C., or through its regional offices in many cities in each state.

The foreword of the booklet says: "Because of the unusually large number of persons who go to Washington, the personnel of the contract distribution office there is taxed beyond its facilities. Officials of small industries are, therefore, requested to contact the regional office nearest the location of their plant. The directors and personnel of these offices are as well versed in giving information as to how contracts can be obtained as the main office in Washington.

"It is the purpose of the contract distribution branch to harness the full productive power of American industry in this Titanic war armament program. Every manufacturer, large and small, can serve his country and himself by making full use of this service."

The booklet contains information on how industry can secure loans for equipment to make war armament, how small companies can form pools to obtain contracts, and other helpful data. A list of regional offices and ad-

NEW COMMERCIAL SIZE MOTOR OPERATED VALVE



GENERAL CONTROLS SERIES G-1

GENERAL CONTROLS NEW SMALL SIZE HYDRAMOTOR VALVE

provides safe, positive control of water, air gas, steam and oil

The positive operation of this valve should appeal to every valve user. Entire operator is sealed in oil for life; no annual maintenance is necessary. Control is simplified two wire current failure type with electrical trip manual reset. Available normally open or normally closed. Hydraulically operated, slow opening and slow closing. No gears and only one internal switch. For low and high pressure operation. Low in current consumption. Operates in any position. Available for use as gas valve with damper arm. Developed as result of demand for small size of our successful Type G-2 large industrial size Hydramotor Valve. Sizes: ⅜" to 3" I.P.S. Both types described in NEW Catalog. Write today for your copy.

GENERAL G C **CONTROLS**
801 ALLEN AVENUE • GLENDALE, CALIFORNIA
BRANCHES: Boston, New York, Philadelphia, Atlanta, Cleveland, Detroit, Chicago, Kansas City, Dallas, Houston and San Francisco

dresses, the names of officers and telephone numbers are included.

A copy of the book can be obtained without charge by writing to the association.

Engineering Data Booklet

A booklet of engineering standards for the use of contractors, engineers, architects and salesmen was published recently by the air conditioning division of Gar Wood Industries, Inc., Detroit, Mich. In its seventy-two 4 by 8 in. pages, it contains a great deal of useful information. Listed price is $1.00.

The content pertains primarily to residential work, although much of the information has wider application.

Metallurgy and Piping

The metallurgical and piping subcommittee of the prime movers committee of the Edison Electric Institute issued as of December, 1941, its 1940 report. A paper covered pamphlet of some 36 pages, it is in three sections. The first contains recommendations of the subcommittee for proper supervision of materials in high temperature steam service as established in recent years. The second section presents a review of developments in piping. The third is a report on the present status of bolting of high pressure and high temperature piping joints, with particular reference to turbine joints.

The section on materials is devoted primarily to creep of piping and standard form sheets and methods for showing high temperature piping data. Probably the most interesting parts of the second section are the re-

Specified FOR THE BIG JOBS

Put yourself in the place of the engineers who specified the steam traps pictured above, for their company's own huge office building, fully air conditioned.

To be secure in your position, YOU TOO would specify Sarco. Not merely because these products were built in the newest, biggest and best plant devoted exclusively to steam traps and control; and not because every Sarco user you talked to said you would make no mistake. It would be because—from every angle—after weeks of consideration you knew that Sarco Steam Traps would substantiate your judgment.

Write for Catalog Nos. 250, 38 and 350.

119

SARCO
SAVES STEAM

SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
SARCO CANADA LTD., FEDERAL BLDG., TORONTO, ONT.

DE-STA-CO

Blower Wheel Housings

of Standard Dimensions

Made in sizes to fit 4½, 5, 6, 7½ and 9 inch wheels and in widths to suit single or double inlet wheels . . . also individual parts for your own assembly.

De-Sta-Co housings are engineered for maximum efficiency and quietness in operation . . . neatly finished. Send for "De-Sta-Co Blower Housings" bulletin; gives complete information, including essential dimensions.

DETROIT STAMPING CO.
Established Over 25 Years
337 Midland Ave • Detroit, Mich.

DOES NOT STAIN HANDS or FIXTURES

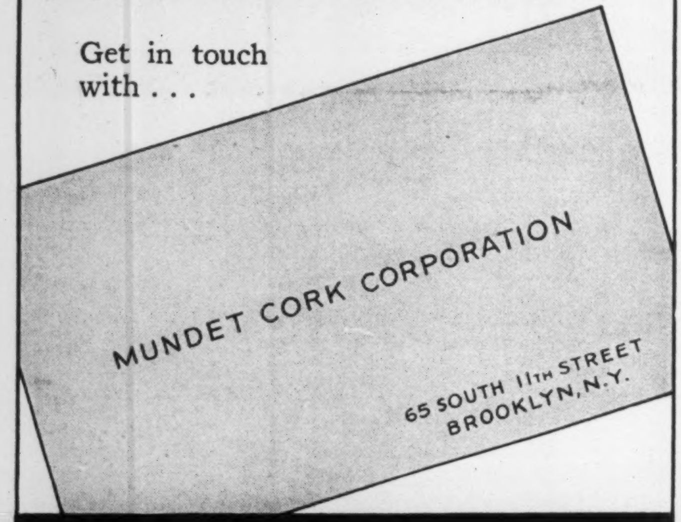
Take a tip from other master plumbers and use Rutland Pipe Joint Cement on every job. It seals joints tightly—lasts indefinitely—yet always leaves pipes easy to disjoin. Legal for use in all cities because no toxic ingredients. Remains soft in can.

Mail post card for free sample. Rutland Fire Clay Company, Department H-3, Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patcher.

RUTLAND
PASTE PIPE JOINT CEMENT
RUTLAND FIRE CLAY CO.
RUTLAND, VT.

When You Need
Information on Insulation . . .

Get in touch with . . .

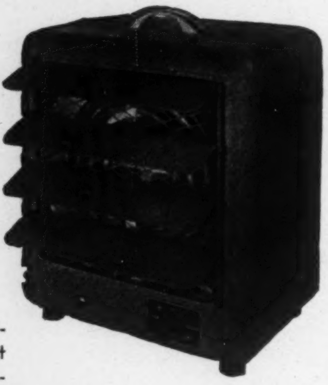


MUNDET
CORK INSULATION
CONSERVES LOW TEMPERATURE

Save on costly Spring-time boiler operation — use ELECTRIC HEAT

The ponderous, bulky, slow steam plant cannot economically cope with the marginal air heating needs of Spring. Save by shutting down boilers a month ahead, and use

CHROMALOX
ELECTRIC
AIR HEATERS



No temperature change too sudden for these heaters. On or off at the turn of a hand, or thermostatically controlled, they give heat only when it's needed. Never too hot—never too cold, regardless of outdoor weather. They make a little heat go a long way, by setting up a warmed air circulation, refreshing and healthful, directed just where it is most needed.

As easily installed as an electric light, Chromalox electric air heaters bring heat anywhere a wire line can go. They save fuel, man-power, heating cost. Check with your power company, or with us.

Above is the Type HF heater available in four sizes from 1.5 to 4-kw. Other types up to 40-kw. for heating factory space and other large areas. Thermostatic control if desired.

These units are widely used for auxiliary heating in plants and offices. Great for extra cold winter days, for overtime heat, for snappy weather in Spring and Fall and (with blower only in action) to circulate air on hot summer days.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh, Pa.

ports of operating experiences, including piping troubles experienced by various stations, large capacity reducing valve exerience, vibration elimination, and growth of corrugated pipe fillers.

Copies of this report, known as EEI publication No. I-6, may be had from the Edison Electric Institute, 420 Lexington Ave., New York, N. Y., for $1.75 to non-members in the United States. The cost to EEI members and their employees is 70c.

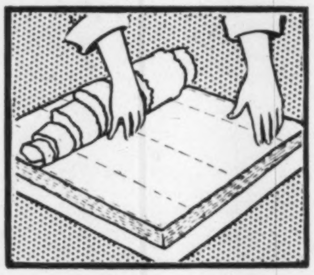
Air Conditioning Metal Layout

Air Conditioning Metal Layout is a new textbook and working guide which presents practical and shortened methods for laying out and forming the patterns used in air conditioning, ventilating and warm air heating. Its author is Joseph J. Kaberlein, instructor of sheet metal apprentices at the Washburne Trade School, Chicago. The book is published by the Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee, Wis. It contains over 300 pages, 6 by 9¼ in. in size, and the price is $3.75.

The content is made up of 171 plates, each presenting a problem and explaining its solution; each plate shows the various patterns, working drawings, perspective views, etc.

The fittings covered combine—in most cases—what would normally require two or more transitions. This is becoming more essential with every installation made for air conditioning, says Mr. Kaberlein in his preface, due to the limited space allowed the sheet metal worker to install his ducts, elbows, change joints, and the like. The necessity of combining an elbow, change joint and angle into one fitting cannot be overestimated, he states,

LOWER FILTER COSTS
with the "200" series Re-Fil-Able
RESEARCH
AIR FILTER
with the exclusive patented
RiP-CLEAN construction



Above, showing how dirt laden filter pad layers are removed renewing filter for continual service.

By tripling filter life, RIP-CLEAN Air Filters save 2/3 filter costs. This is done by removing lint coated filter layers, 2 at a time, until half of the 20 filter layers have been removed. Air-cleaning efficiency of approximately 93% is maintained.

RESEARCH PRODUCTS CORP.
MADISON, WISCONSIN

Plant Fire Protection

The saboteur and the bombardier have brought a new fire menace into industry, for fire today is a major instrument of war and one that requires a new defense in depth, a new alertness on the part of every worker.

But in war, as in peace, fire takes its greatest toll as a result of carelessness and ignorance. It's not Lady Luck alone that protects those plants that have enjoyed immunity from serious fires for a great length of time. Such good records are the results of long preparation in fire protection: Fire resistive construction; proper fire-fighting equipment; employee organization for fire safety.

Of these three, employee organization for fire safety is of prime importance, yet much neglected. A new booklet, just published by one of the foremost fire combating organizations in the country, the National Fire Protection Association, tells how to organize employees for protection against fire — whether accidental or deliberate.

Copies of this booklet are available for 25c from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

V **"The salvage and collection of scrap metal—every possible pound—is a pressing necessity and an imperative task which all industries are now called upon to assume. Its importance from the standpoint of metals production is vital."—Robert A. Wheeler, at the February 6 meeting of the Eastern Industrial Advertisers.** V

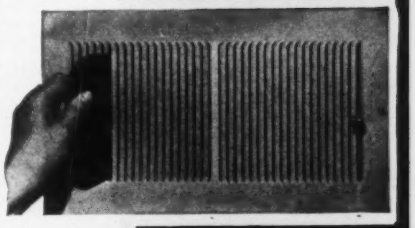
Be Sure! Specify STANDARD for SATISFACTION!

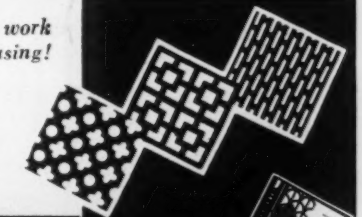
Insure better installations and customer satisfaction with STANDARD'S extra margins of quality, efficiency and adaptability. A STANDARD job today . . . more jobs tomorrow!

REGISTERS
GRILLES
PERFORATIONS
INDUSTRIAL SCREENS
PANELS

"BEND-EZY" REGISTERS

"Bend-Ezy" Registers provide top efficiency at moderate cost on heating and ventilating requirements! Simple, adjustable, durable, modern . . . *ideal to work with on low-cost defense housing!*





STANDARD GRILLES

"Dress up" the installation with "Bend-Ezy" Grilles. Modern designs please finicky customers!

STANDARD
STAMPING & PERFORATING COMPANY
3151 W. 49th PLACE · CHICAGO, ILLINOIS

FREE CATALOG! Factual — Informative. Write for yours today.

AIR CONDITIONING NOZZLES

Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-616.

YARNALL-WARING COMPANY
107 MERMAID AVENUE
PHILADELPHIA

YARWAY

Use **Felt..**

MAXIMUM EFFICIENCY IN AIR CONDITIONING

Western's Wool Felt is specially designed to eliminate three difficult problems in air conditioning units:

(1) Condensation is eliminated on the outside and inside of the air ducts with a Western Wool Felt covering and lining.
(2) *Destructive vibration is eliminated* with Western Wool Felt.
(3) Equipment must operate quietly. Western Felt subdues noise of air passing through ducts, and when placed under motors, subdues motor noise.

These are vital factors in the successful operation of any air-conditioning unit.

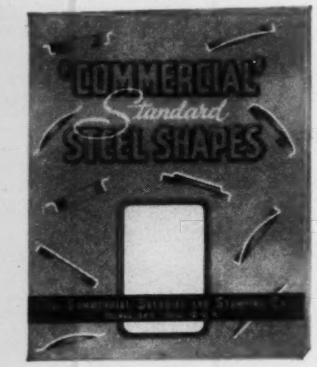
Write for complete information including free samples and booklet describing the use of felt in this important field.

WESTERN FELT WORKS
4033-4115 OGDEN AVENUE CHICAGO, ILL.
Largest Independent Manufacturers and Cutters of Wool, Hair and Jute Felt. Established 1899.
BRANCH OFFICES IN ALL PRINCIPAL CITIES

STAMPINGS

ARE YOU IN NEW MANUFACTURING LINES?

Looking for something you never bought before? If it is Stampings, Steel Heads, or Steel Shapes "COMMERCIAL" is the place to go.



Our new "SHAPE" booklet may solve a problem. Steel shapes that are available without die or tool charges, also heads of various styles.

Write for Shape Book or Head catalog.

The COMMERCIAL SHEARING & STAMPING COMPANY
YOUNGSTOWN, OHIO.

THERM-O-TILE
Reg. U. S. Pat. Off.

UNDERGROUND PIPE CONDUIT

See our page in Sweet's or The Heating Guide.

Sold and installed by Johns-Manville Construction Units in all Principal Cities.

Therm-O-Tile is the Simplest, Strongest, Most Efficient, and Only Truly Complete Conduit for Underground Pipe Lines. Unyielding monolithic concrete base. No broken stone fill. No bell joints. Build to correct grade with Therm-O-Tile and that grade will never change. Condensate pockets cannot form. Strong arched construction. Internal channel drain. Etc. Bulletin 381 gives details.

H. W. PORTER & CO., Inc.
822-H Frelinghuysen Ave., Newark, New Jersey

Coming Events

Industrial and Commercial Gas Conference: March 12-13, Hotel William Penn, Pittsburgh, Pa. Papers to be presented include discussions on meeting the problems of rapidly expanding war production, by Henry M. Heyn, Surface Combustion Div. of General Properties, Inc.; industrial space heating, sponsored by a committee of which James E. Dare, Public Service Co. of Northern Illinois, is chairman; gas equipment developments and their application to war production, by Lee Wilson, Lee Wilson Engineering Co.; gas in the all-out industrial effort, by W. Trinks, Carnegie Institute of Technology; and others. Sponsored by American Gas Association, 420 Lexington Ave., New York, N. Y.

Industrial Advertising Conference: Midwest regional conference of the National Industrial Advertisers Association to be held Friday, March 13, in Chicago.

Forced Warm Air Conference: 11th annual forced warm air conference, March 23-26, Michigan State College, East Lansing, Mich. Sponsored by mechanical engineering department of Michigan State, and National Warm Air Heating and Air Conditioning Association. For further information, write Professor Lorin G. Miller, Michigan State College, East Lansing, Mich.

Engineering Production for Victory: Spring meeting of ASME, March 23-25, Rice Hotel, Houston, Texas. Program includes papers on production, distribution and utilization of natural gas, by W. B. Poor; protection of buried metals against corrosion, by Starr Thayer; cathodic protection for corrosion prevention, by R. J. Sullivan; heat transfer coefficients and friction factors for tubular heat exchangers, by B. E. Short; condensation of saturated "Freon-12" vapor on a vertical bank of horizontal tubes, by W. J. Wohlenberg and F. L. Young, Jr.; and others. Headquarters office of the American Society of Mechanical Engineers is at 29 W. 39th St., New York, N. Y.

Midwest Power Conference: April 9-10, Palmer House, Chicago, Ill. Sponsored by Illinois Institute of Technology, other midwestern universities and colleges, and local sections of engineering societies. Charles A. Nash, conference secretary, c/o Illinois Institute of Technology, Chicago, Ill.

Foundry Convention and Show: 1942 "win the war" convention and show, April 20-24, Cleveland, Ohio. American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

Heating, Piping and Air Conditioning Contractors National Association: 53rd annual convention, May 25-28, Hotel Schroeder, Milwaukee, Wis. George J. Stoehr is chairman of the local convention committee. Headquarters office of HPACCNA, 1250 Sixth Ave., New York, N. Y.

American Society of Refrigerating Engineers: Spring meeting, June 7-9, Skytop Club, Skytop, Pa. Discussion of expansion of air conditioning of blast furnaces is among the subjects planned for the program. Headquarters office of the ASRE is at 50 W. 40th St., New York, N. Y.

THE EDITOR'S PAGES

RADIO COMMENTATOR EXPLAINS IMPORTANCE OF AIR CONDITIONING FOR WAR PRODUCTION

Major fields in which air conditioning equipment is speeding America's ultimate victory over the axis powers were described in a recent broadcast by Fulton Lewis, Jr., journalist and commentator. Mr. Lewis, interviewing Dr. Willis H. Carrier, told a nationwide radio audience that "this is an industry which affects all war production."

"Air conditioning helps increase our supply of strategic raw materials," Mr. Lewis asserted. "It makes possible the mining of copper at depths which would otherwise be impossible because of the heat radiated by the earth. Likewise, air conditioning equipment increases steel production through 'air conditioned' blast furnaces.

"In a second major field, air conditioning makes possible the precision manufacture of ammunition and guns and tanks and airplanes," he said. This is due in large part to the fact that modern war industries require precision as close as one ten-thousandth of an inch, and variations in temperature cause contraction and expansion of metal which makes such precision impossible.

"Third," Mr. Lewis pointed out, "where raw materials like rubber or silk have been cut off, this industry plays a vital role in producing substitutes."

Hitting at the popular misconception of air conditioning as something that is used merely for comfort, Mr. Lewis said that the words "air conditioning" had always made him think of a cool motion picture theater on a hot day, or of a sleeping compartment in a train free of soot and stale air. That picture, he said, had been erased from his mind, for in the largest air conditioning plant in the world, men are working night and day producing for war. They have not converted over to the making of shells or tanks or guns, but are still making machinery to cool air. But not for movie shows and stores. These men are making air conditioning equipment to beat the axis powers. To get the tanks, guns, high explosives and planes we need, and to get them better and faster than ever before, requires refrigerating and air conditioning machines, he said.

The builders of Strong traps and steam specialties recently donated overtime cash to help Uncle Sam buy another bomber. J. L. Mainwaring, plant manager, said that "the boys on both shifts volunteered to work five hours extra and the company matched the workers contribution through payment of double time."

$7,366,000,000 FOR WAR PLANT EXPANSION APPROVED PRIOR TO 1942

The estimated cost of war industrial plant expansions approved through December 31, 1941, totaled $7,366,000,000, the statistics division of the War Production Board announced last month.

Commitments of public funds, including those of foreign governments financing factories in the United States, amounted to $6,040,000,000, or 82 per cent of the total estimated cost. Of this, commitments by the United States government totaled $5,885,000,000, and those of foreign governments amounted to $155,000,000. The estimated cost of private expansions, as represented by necessity certificates approved, was $1,326,000,000.

Plant expansions estimated to cost approximately $991,000,000 were approved during December. Of this amount, the United States government made commitments totaling $818,000,000, while private financing, as measured by necessity certificates approved, amounted to approximately $173,000,000.

Comments of occupants of air conditioned buildings are often most revealing to the air conditioning engineer. The man who designs, installs or operates an air conditioning system is so familiar with the process and the service it performs that he sometimes doesn't realize it may be more or less of a mystery to the occupants of the space served.

In going through the air conditioned office portion of one of the new war production plants the other day, we noticed that one of the windows was open—and asked a girl sitting directly under one of the ceiling air diffusers "why so"? She said she knew that the air diffuser had something to do with the air conditioning, but "the hole was entirely too small for good ventilation" so she thought she'd better open a window.

THE WAR PRODUCTION DRIVE

Greater Plant Efficiency Through Cooperation

A Statement by Donald M. Nelson
Chairman, War Production Board

The war production drive is a voluntary effort. Its success is up to the men and women, labor and management in the plants.

The plan provides for joint committees representing labor and management in each plant to stimulate war production.

This drive is designed to increase the production of weapons now and not to further the special interests of any group. It is not a plan to promote company unions. It is not a device to add to or tear down the power or position of any union. It does not interfere with bargaining machinery where it exists. It is not designed to conform to any plan that contemplates a measure of control of management by labor.

It does not put management in labor or labor in management. It is not a management plan, a labor plan, or any other plan. It is the war production drive plan. It is a perfectly simple, straightforward effort to increase production.

The plan calls for greater plant efficiency through cooperation. That means if anyone has a suggestion as to how we can do our job faster and smoother, that suggestion must be passed along to where it will do the most good—the most good for our country and for free men and women everywhere.

THE EDITOR'S PAGES

Continued

DIRECTORY OF WAR WORK TO BE SUBCONTRACTED

A directory of war work to be subcontracted will be tried on a limited scale in the Chicago area in the near future, it was announced last month by William H. Harrison, director of production of the War Production Board. In the test, selected prime contractors will list the work they have to be done, by separate parts, classifying each by the machine needed to make it, the tolerances required and the hours per week these machines have to work. This information will be coded and arranged alphabetically so that prospective subcontractors can readily find the jobs that will fit their idle machines.

William S. Shipley, chairman of the board of York Ice Machinery Corp., and father of the famous York plan of cooperative community war work, was presented a citation of merit at the recent award dinner of the National Association of Publicity Directors. The citation, which was presented by Dwight Anderson, chairman of the executive committee of the association, was awarded "for his splendid application of the principles of public relations in the development and furtherance of the York plan—work of the highest value in the building of the nation's defenses and an example of industrial statesmanship of the sort that the crisis of our times requires."

YOUNG RADIATOR SETS UP OWN WAR PRODUCTION BOARD

In answer to the March 2 radio appeal of Donald Nelson, War Production Board chairman, for greatly increased production of war materials, Young Radiator Co. announced the appointment of a company war production coordinating board headed by L. C. Pfost, plant superintendent, and Blendon DeMint, president of Young local No. 37 CIO, UAW. Two additional board members will be selected, one from the ranks of the plant workers and the other from the office force.

The functions of the board, according to Fred M. Young, president of the company, will be to study production incentive plans in operation elsewhere, to institute a program to acquaint all employees with the company's war production goals, and to cooperate with military and government officials.

Persons seeking preference ratings to purchase air conditioning or commercial refrigeration equipment were urged last month by WPB's air conditioning and commercial refrigeration branch to submit in detail all information called for on forms PD-1A. The priorities section has been experiencing difficulty and delay in attempting to appraise applications because of the sketchy information submitted, particularly on Questions 2, 3 and 7.

Question 2, relating to the function of the equipment desired to be purchased and the type of establishment in which it would be installed, is extremely important; applicants must furnish information on whether the equipment would replace, repair or expand existing facilities, and must state definitely whether or not a complete new installation is contemplated.

Question 3 requires a complete description of the material wanted, and the name of the supplier. Under this question, applicants also must give the dates of any other preference rating applications they may have pending, and state whether they intend to file additional applications.

Question 7 relates to the supply situation in the event a rating is not obtainable. If an applicant's request is for various products which will go into inventory, the present inventory position on each item should be clearly outlined under this question, and the per cent of annual consumption of present inventory should be stated.

FUNDAMENTAL CHANGE IN PRIORITIES SYSTEM ANNOUNCED

A fundamental change in the priorities system was announced March 21 by J. S. Knowlson, director of industry operations, War Production Board. A specific requirements approach to the control and distribution of scarce materials will replace the use of general or blanket priority rating orders as rapidly as the necessary new orders and procedures can be put into effect. Between April 1 and June 30, most of the blanket rating orders will be revoked or allowed to expire, and companies which have been operating under blanket ratings will be required to apply for priority assistance under the production requirements plan.

The rapidly increasing materials requirements of the war program make it impractical to continue the use of preference ratings which have been assigned under existing "P" orders to whole industries, without any exact check of the amount of material which such ratings may be used to obtain. Through the production requirements plan, the director of industry operations will continue to assign ratings to deliveries of materials for essential uses, but the rating assigned in each case may be used to obtain only a specified quantity of materials or products.

The effect of placing virtually all of American industry, including producers who supply the Army and Navy, under the production requirements plan will be to give the War Production Board closer control of the distribution and use of all scarce materials. The most important raw materials, such as aluminum, copper, steel plates, etc., are already allocated at the producer's level. General use of the production requirements plan will provide control of the flow of these materials down to the level of end products.

Appointment of H. M. Brundage as chief of a newly created appliance section in the WPB plumbing and heating branch was announced last month.

HOWARD COONLEY APPOINTED CHIEF OF SIMPLIFICATION BRANCH

The appointment of Howard Coonley as chief of the simplification branch of the bureau of industrial conservation of the WPB was announced last month by Lessing J. Rosenwald, chief of the bureau. Mr. Coonley, chairman of the board of the Walworth Co., replaces Dr. Edwin W. Ely, who recently was called back to his post as chief of the division of simplified practice of the National Bureau of Standards. Dr. Ely was loaned to the bureau of industrial conservation when the simplification branch was organized.

Equipment Developments

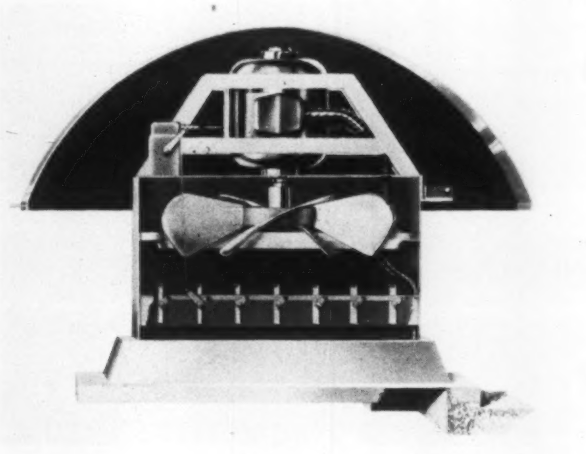
For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1942, HEATING, PIPING & AIR CONDITIONING *and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed*

Blackout Ventilators

No. 2249—Positive ventilation for blackout plants in which work must be carried on despite the possibility of air raids is provided by a new line of blackout ventilators available in three basic models: exhaust unit, summer supply unit, winter supply unit.

The summer unit is designed to provide large volumes of outside air with perceptible air motion at all times. It is a positive means of introducing air for ventilation and for reducing solar heat gain. The use of a unit of this type is generally found necessary in the case of large industrial plants or where ventilation for particular industrial processes is needed. Conventional types of diffusion outlets may be used.

The exhaust unit has the same general design as the summer unit and, as the name implies, is merely an exhaust fan arrangement whereby the air in occupied areas is exhausted from the building. In areas in which a tremendous amount of air is being introduced, it is necessary to provide some mechanical means of removing the air.



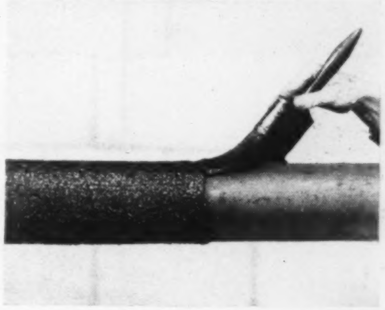
The winter unit is designed for application in conjunction with the existing heating system, and contains heating coils, face and bypass dampers and a propeller fan. Any of the accepted methods of temperature control may be provided, and practically every type of diffusion arrangement is practical. The maker's standard blower type unit heater—the inverted wall type or, in some cases, the ceiling type—also can be used in applications of this nature.

These blackout ventilators are easy to install, the manufacturer says. The provision of a simple curb is all that is needed. The units include grease-lubricated motors and do not require attention more than once every six months. All maintenance can be accomplished from the rooftop, where the units are placed, rather than from below. The motor and hood assemblies are designed for easy maintenance. The hood arrangement hinges upward, exposing the motor and blower assembly as well as the damper motor and its linkage. The hood is locked in place in the open position, so that wind or other accidental means will not cause it to suddenly drop, and also may be locked in the closed position. Handles are provided for convenience. The damper motor, fan motor, and transformer (when required) are completely wired and tested for installation. The control is arranged so the damper is closed when the fan motor stops and open when it starts.

The ventilators are shipped completely assembled. Capacities range from 1500 to 20,000 cfm.—Trane Co., LaCrosse, Wis.

Cork Coating Stops Condensation Drip

No. 2250—After three years of research and tests under various conditions, an improved plastic cork coating—called "No-Drip"—has been announced. It is used to stop dripping from condensation due to sweating pipes, walls, ceilings, tanks, etc. The first product of this kind introduced by this manufacturer for the same purpose



For Your Convenience

[4-42]

HEATING, PIPING & AIR CONDITIONING,
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature." (*Circle each number in which you are interested*):

2249 2250 2251 2252 2253 2254 2255 2256 2257 2258
2259
4135 4136 4137 4138 4139 4140 4141 4142 4143 4144
4145 4146 4147 4148 4149 4150 4151 4152 4153

Name.................................... Title................

Company ....

Address ....

City.................................... State................

was limited in its use to large areas because it required power spray equipment to apply it. Method of application of the new product is by using an ordinary paint brush.

This coating is spread $\frac{1}{4}$ in. thick over any metal, concrete, brick, plaster, tile, wood, composition, galvanized or painted surface, corners, angles or corrugated ceilings. It can be painted any color.—J. W. Mortell Co., Kankakee, Ill.

Unit Heaters Solve Foundry Problem

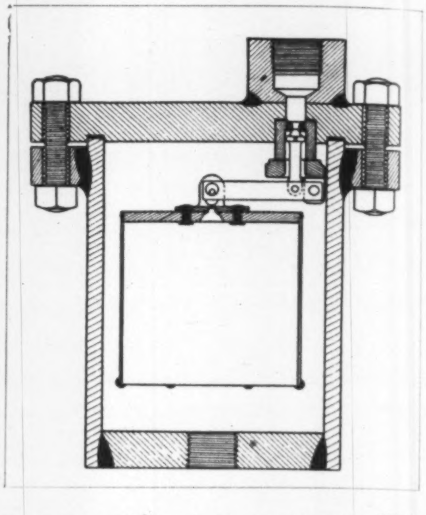
No. 2251—A solution to the foundry problem of free dust and sand settling into molds and causing casting rejects has been found by the American Magnesium Corp. It is a new heating and ventilating system, which by means of amount, direction and rate of air delivered, prevents dusts from being blown about and dilutes the unpleasant, smokeladen atmosphere.

The equipment consists of 10 "Thermadjust" heat diffusers, supplying 135,000 cfm of outside air to the foundry. The units maintain comfortable working conditions.

Mounted in an inverted position along the side walls, the heating units are 9 ft above floor level. From long slotted outlets, a low velocity flow of outside air is fanned downward and toward the center of the floor at the correct temperature to offset heat losses through the ventilators. One of the advantages claimed for the system is that overblows, which swirl dust and other impurities around the foundry without forcing them toward the ventilators, are eliminated by discharging the air at low velocity.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Welded Steel High Pressure Trap

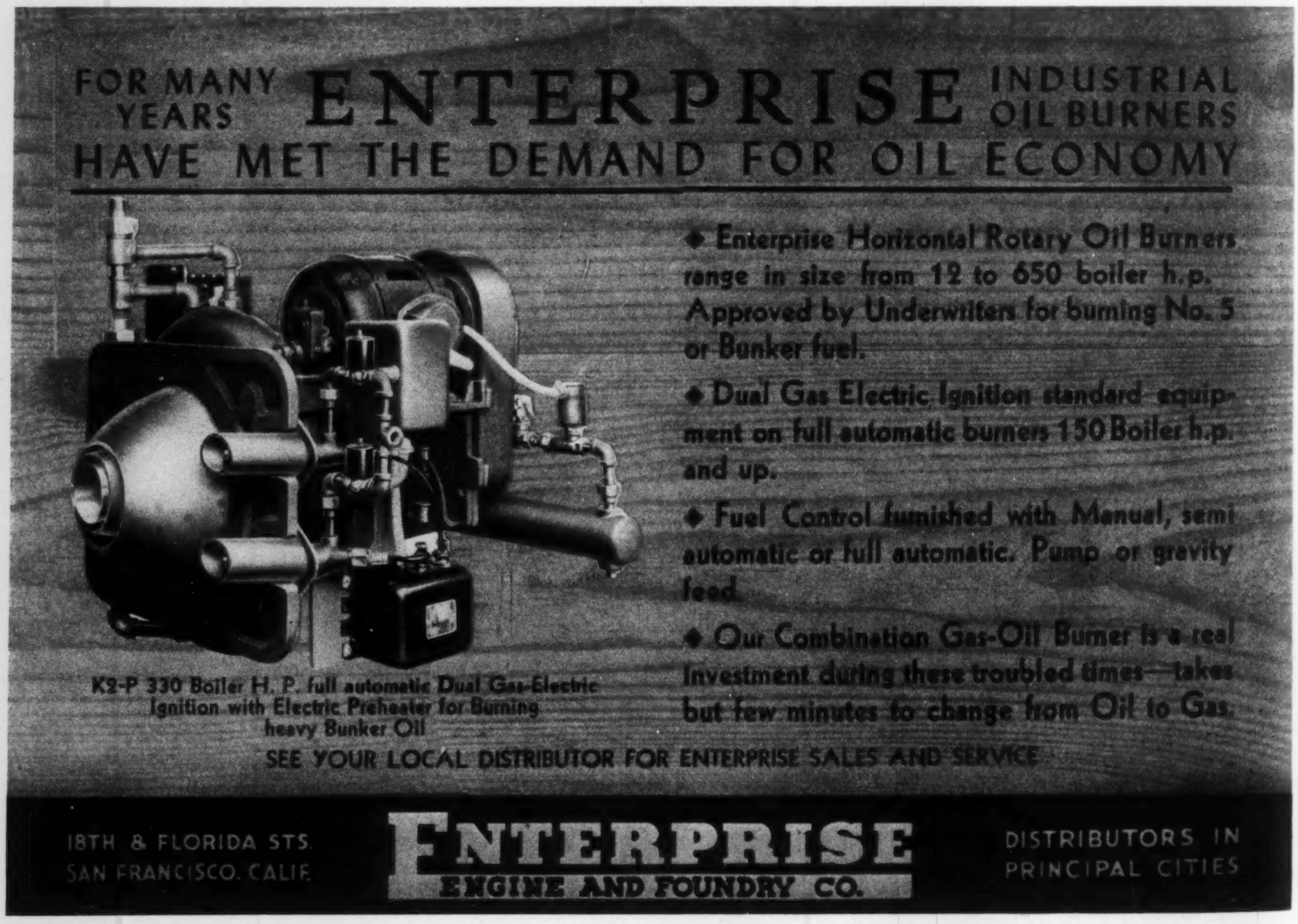
No. 2252—A welded steel trap for draining lines up to 600 psi pressure and 750 F was introduced last month. Operating parts include a stainless bucket, "Anum-Metl" valve seat pins, a patented anti-balancing device, and an easily inspected, internal bolted in (not screwed) seat.



The trap body is seamless steel tubing with steel cover. All welds are fabricated by certified methods and operators, says the maker, and each trap is hydrostatically tested at twice rated pressure plus an operating test on steam—The Strong, Carlisle & Hammond Co., 1392 W. Third St., Cleveland, Ohio.

Glass Block for Factory Sash

No. 2253—A solution to the problem of maintenance and replacement of factory sash is suggested by recent experiments, the objectives of which were to develop a set of emergency specifications that would permit the



FOR MANY YEARS ENTERPRISE INDUSTRIAL OIL BURNERS HAVE MET THE DEMAND FOR OIL ECONOMY

- ◆ Enterprise Horizontal Rotary Oil Burners range in size from 12 to 650 boiler h.p. Approved by Underwriters for burning No. 5 or Bunker fuel.
- ◆ Dual Gas Electric Ignition standard equipment on full automatic burners 150 Boiler h.p. and up.
- ◆ Fuel Control furnished with Manual, semi automatic or full automatic. Pump or gravity feed.
- ◆ Our Combination Gas-Oil Burner is a real investment during these troubled times—takes but few minutes to change from Oil to Gas.

K2-P 330 Boiler H. P. full automatic Dual Gas-Electric Ignition with Electric Preheater for Burning heavy Bunker Oil

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Announcing Great . . Good **NEWS** *to* Refrigeration Users . . . New A-P

TR-AP-DRI

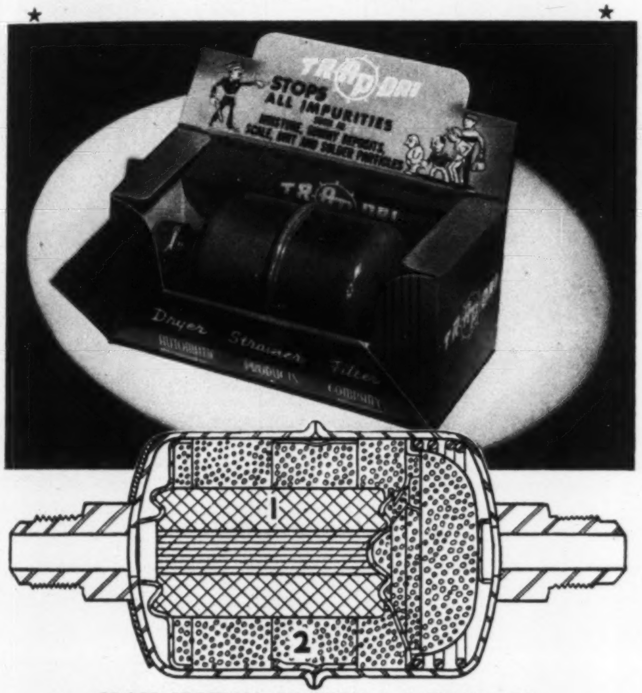
A SINGLE Unit that STOPS ALL IMPURITIES!

Moisture, Scale, Dirt, Solder and Gummy Deposits

Combining the well-known A-P "Trap-IT" element, PLUS SILICA GEL, the new A-P "TRAP-DRI" is the ONLY unit on the market that actually dries, strains and filters the refrigerant, performing THREE important jobs at once! The "Trap-IT" Unit positively prevents foreign particles from entering the system. The Silica Gel removes acids, moisture and corrosive compounds by quick absorption.

EFFICIENT "SYSTEM-PROTECTOR"

TRAP-DRI provides 100% protection for your system. Permits smooth valve operation, prevents freeze-ups.



CROSS-SECTION OF NEW A-P TRAP-DRI

1. "Trap-It" Element consisting of honeycomb filter tube equal to 900-mesh strainer.

2. Silica Gel unit, the most efficient of all drying agents.

NO PRESSURE DROP . . .

There is no noticeable pressure drop in the "Trap-Dri"—an important advantage in any system.

Make YOUR Refrigeration Systems more Efficient and Dependable with the new A-P "TRAP-DRI." Carried in stock by best Jobbers everywhere.

Refrigeration Service Engineers! Your work is IMPORTANT to National Defense NOW! Let A-P Dependable Valves help you keep Refrigeration at peak efficiency.

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY—SECOND STREET
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DEPENDABLE *Refrigerant Valves*

THE BIG SWING IS TO THE

AEROFUSE OUTLET

. . . AND FOR GOOD REASON!

The Aerofuse Outlet, made in five types for every installation requirement, performs with that efficient perfection so typical of Tuttle & Bailey products. In addition, it is a most unobtrusively attractive ceiling diffuser. Because of the simplicity of its design and the mass production economies possible in its manufacture, the cost is surprisingly low. If you are not specifying the Aerofuse diffuser now—investigate!

PROVIDES:

1. Maximum Air Mixture.
2. Rapid Temperature Equalization.
3. Perfect Air Distribution.
4. Total Elimination of Drafts.

T & B

TUTTLE & BAILEY, Inc.
NEW BRITAIN, CONN.
NEW YORK CHICAGO PHILADELPHIA HOUSTON

Asbestos Protected

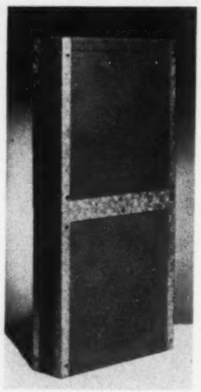
1-DUX-SULATION

A flexible insulating blanket $1/2''$ thick having a K factor .27 B.t.u. Comes complete with corner tape and adhesive for cementing on to sheet metal duct work. Dux-Sulation comes 36" wide in a roll containing 100 square feet. Easy to apply and a very efficient insulation against temperature losses, condensation and noise travel. Will not rot, chip or crack.

★

2-A·R·A SHEETS

National Defense regulations restrict the use of metal for duct work. A.R.A. Sheets are designed and made to replace much of the metal in duct work. A.R.A. Sheets are an Asbestos-Clad Board from which ducts may be fabricated. They are tough (200 lbs. per sq. in. Mullen tested), smooth, waterproofed and high insulating (K .45) and sound absorbing efficiency.



3-DUCT JOINTS

This asbestos flexible duct connection is an Asbestos Woven Fabric for making a flexible tight, fire-safe, permanent joint between metal duct sections to absorb vibrations and sound travel. Comes in a roll 6" wide, 50 feet long with selvaged edges. Can be screwed, clamped or bolted into place.

★ ★ ★

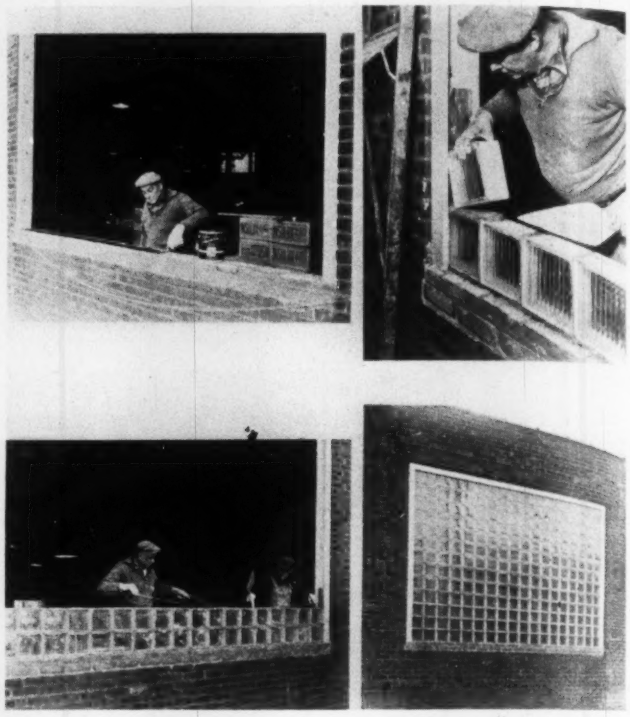
Write for Samples and Information

GRANT WILSON INC

4101 WEST TAYLOR ST., CHICAGO, ILL.

use of glass block panels in situations where priority materials are not available.

Actual factory openings were studied in the tests. The old sash was first removed, the masonry opening trimmed up and the sill painted with an asphalt emulsion which was especially developed for use with glass blocks.



Wood chases were then erected at the jambs and head, after which expansion strips were put in place. The glass blocks were then laid up in mortar; the panel edges were packed tight with oakum, then caulked. Cleaning completed the job.

The tests showed that the use of wood chases and filler strips to compensate for any difference between block units and the size of the existing opening provide a practical solution. If necessary, these wood members can be easily replaced, or covered with kalomein or metal plates after the emergency. In some instances, chases can be cut in existing masonry, eliminating the need for wood chases.

The use of glass block panels has several industrial advantages, in addition to their availability and adaptability, the manufacturer states. First, rust and corrosion are eliminated. Condensation, cause of most rusting and deterioration, is also practically eliminated in all but extreme conditions, for glass block panels have an insulation value approximately 60 per cent better than sash. This sealed, insulating construction permits better control of heating and air conditioning, combined with a reduction in objectionable condensation.

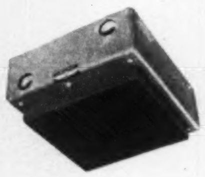
In those cases where it is necessary to provide for ventilation in the panel, this was provided for by means of wood sash in wood frames inset in the glass block panel. The sash opening was so sized that the wood sash and frame could be removed at some later date and refitted with standard size steel sash.—Owens-Illinois Glass Co., Insulux Products Div., Toledo, Ohio.

Solenoid Operated Butterfly Valve

No. 2254—A recent application of the butterfly valve for emergency duty has met enthusiastic reception be-

YOUNG VERTIFLOW UNIT HEATERS

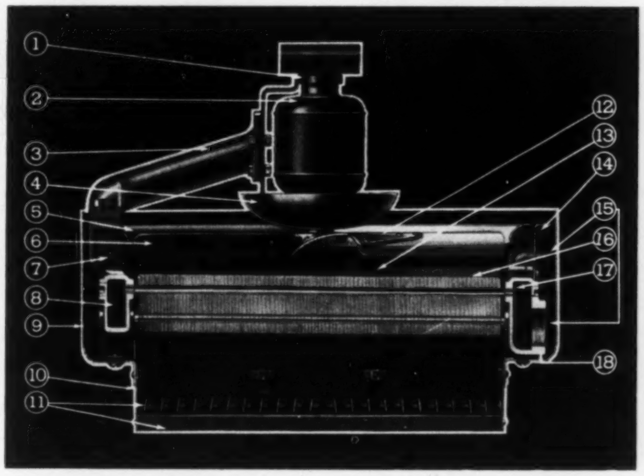
BUILT FOR THE 1942 MARKET



The YOUNG VERTIFLOW with its exclusive patented features is a *superior* unit heater. Study the illustration at the right and you will see why. Note the well-designed, sturdy construction . . . the careful attention to every detail. YOUNG offers a wide line of unit heaters ranging in capacity from 19,000 to 800,000 B. t. u. per hour and with both horizontal and vertical discharge. Ask your YOUNG representative for engineering data, or write to the—

YOUNG RADIATOR CO.
Dept. 112-D, Racine, Wisconsin

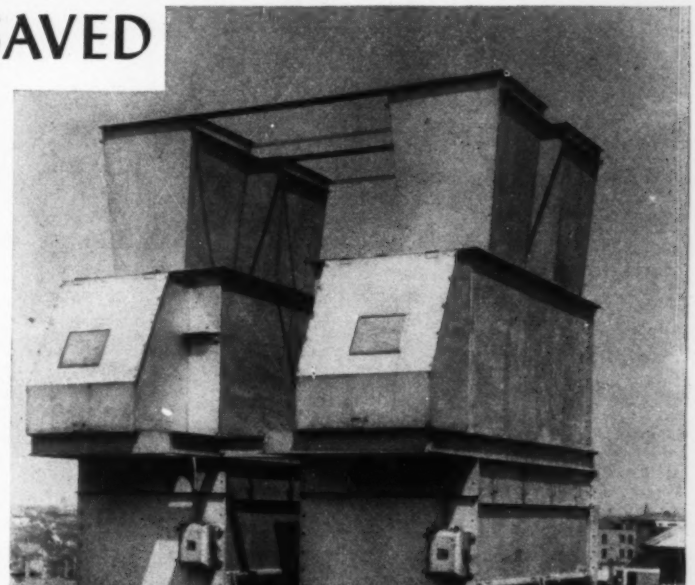
★ ★ ★ ★ ★



1. Insulated motor mounting.
2. Specially built motor.
3. STREAMAIRE motor bracket.
4. Insulated motor shield.
5. Aerodynamic fan shroud.
6. Quiet, high capacity fans.
7. Motor bracket support integral with end tank.
8. One piece cast end tank.
9. All-welded steel casing insulated from heating element.
10. Diffuser casing.
11. Adjustable diffuser louvers.
12. Heavy stamped steel spider.
13. Heating element split and pitched for proper draining.
14. Corner holes for hanger rods.
15. Large supply and return tappings on same end.
16. Fins mechanically bonded.
17. Seamless tubes rolled into headers, ferrule reinforced.
18. Special close grain cast iron headers. One piece.

Young HEATING, COOLING AND AIR-CONDITIONING UNITS

15% to 35% of POWER SAVED



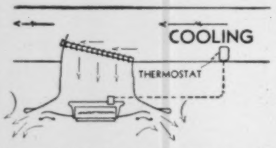
This user of the NIAGARA PATENTED DUO PASS EVAPORATIVE CONDENSER not only saves the cost of 16,000 gallons of water per hour in peak load seasons, but also has the advantage of a net year 'round power saving of 15% to 35% in spite of addition to the previous connected load.

The patented NIAGARA DUO PASS lowers condensing temperatures, prevents scale formation, assures that the savings of evaporative condensing will be maintained for many more years than with ordinary equipment.

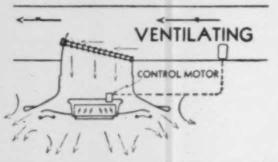
NIAGARA BLOWER COMPANY
Dept. HP-42
6 E. 45th Street, New York City
37 W. Van Buren St., Chicago, Ill.
Fourth & Cherry Bldg., Seattle, Wash.
673 Ontario St., Buffalo, N. Y.

Sales Engineers in Principal Cities

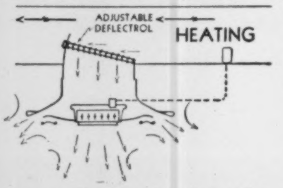
NIAGARA *INDUSTRIAL* COOLING • HEATING • DRYING
HUMIDIFYING • AIR ENGINEERING *EQUIPMENT*



A thermostat in the supply duct positions the blades in a multi-vane damper unit below the throat. With cooling air, the damper is closed, and the air is all diffused outward to fall naturally toward the floor.



With air at ventilating temperature, the damper is partly opened to force a portion of the air in a mostly downward direction. One thermostat in the fan system will control a number of the Air Diffuser units.



To overcome the natural tendency of warm air to rise, the dampers are fully open and the main body of supply air forced directly downward toward the floor. High temperature gradients between ceiling and floor are eliminated.

NEW!

THERMOSTATICALLY CONTROLLED

venturi-flo

AIR DIFFUSERS

BARBER-COLMAN originates a much-needed unit — a ceiling-type air diffuser with *automatically controlled* directional air throw. In places with high ceilings where both heating and cooling are required in the course of the year, this new unit will provide correct air distribution under all conditions *without the need for any manual readjustment.*

FOR HIGH CEILINGS

The first installation of these units is going into a huge war materiel plant having 40 feet of clear headroom under the trusses, and with supply air temperatures ranging from 60° for cooling to 100° for heating. Thorough preliminary tests, made in an existing building of comparable height, assure that the desired results will be obtained. Further details may be obtained through your Barber-Colman representative.

BARBER B-C COLMAN

BARBER-COLMAN COMPANY
1228 ROCK ST., ROCKFORD, ILLINOIS

cause of its quick, automatic action, according to the manufacturer.

This solenoid operated valve provides two position control—either automatic opening or wedge tight shut-off in case the electric power fails or is turned off due to any war emergency. In an open position the butterfly vane is held open by the magnetic action of the solenoid. When the electric power is shut off the trigger is tripped and the counterweight closes the butterfly vane by gravity.

In case of fire due to incendiary bombing, for instance, the valve in a gas or chemical line would be set for automatic closing. Should explosive or poisonous gases escape, automatic opening of an air pressure line would minimize the danger of personal injury or property damage.

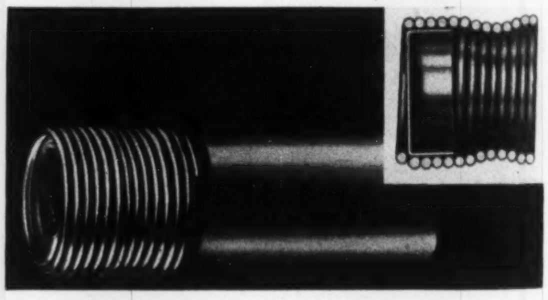
The valve itself can be constructed of any metal alloy and in various sizes for air, gas, steam, oil, hydraulic and other services. It must be reset by hand.—R-S Products Corp., Germantown Ave., at Wayne Junction, Philadelphia, Pa.

Soldering Aluminum

No. 2255**—A special solder has been developed for the soldering of metals such as aluminum, aluminum alloys, die cast, "Dowmetal," "Almico," etc. The material is free flowing and provides high tensile strength in sheet metals and extruded aluminum, the maker states. It retains the color of aluminum and "Dowmetal," and is corrosion resistant.—Lloyd S. Johnson Co., 2241 Indiana Ave., Chicago, Ill.

Metal Caps Protect Tubing

No. 2256—Designed to protect plain end and beaded tubing from handling knocks and shocks and to seal out dirt, dust and moisture, a new line of flexible metal caps, for which patents are pending, has been announced. A unique steel spring is incorporated in these new caps which are sold under the trade name "Flex-Caps."



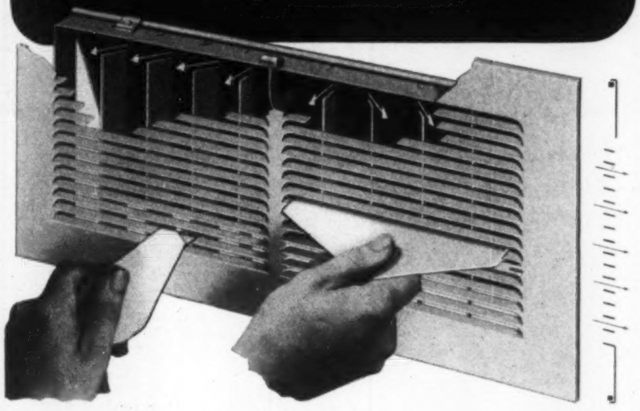
Due to the fact that these caps can be attached quickly and re-used many times, the manufacturer claims they are far less costly than other types; being of steel, cadmium plated, there is no danger of particles chipping off and entering the tubing, nor of tubing becoming damaged when dropped or struck, it is said. The caps are available to fit all standard tubing from $\frac{3}{16}$ to 2 in.—Tubing Seal-Cap, Inc., 215 W. 7th St., Los Angeles, Calif.

Low Temperature Insulation Board

No. 2257—Production of the new "AE" (asphalt enclosed) board for low temperature and roof insulation has been announced.

This insulation board is made of pure glass fibers, compressed to a density of 6 lb per cu ft and completely

INDEPENDENT
Air Conditioning Registers



No. 439 Meets Every Requirement
FOR DEFENSE HOUSES

This improved register affords the widest latitude in deflecting air flows four ways. Valve opens complete 90 degrees to admit full flow of air from horizontal air duct. Simple, modern design conserves material and presents handsome appearance. And equally important, it is moderately priced to give big value. Made in sizes to meet all standard requirements. Send for catalog.

HORIZONTAL GRILLE BARS, formed in the wrought steel face, are set to deflect air flow about 15 degrees downward. Being flexible, they may be bent, before or after installing, to direct the air flow to any other angle upward or downward, or straight outward.

VERTICAL DEFLECTING VANES attached to the back of the register face direct the air flow straight outward in the center, 30 degrees right and 30 degrees left—the arrangement required for most installations.

These deflecting vanes also are flexible and may be set to direct the air flow all right, all left, or any combination of directions.

Grille bars and deflecting vanes are easily adjusted with tool accompanying each shipment.

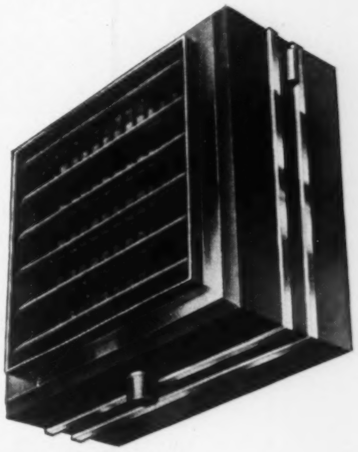
Always leading, Always progressing.

42C

The INDEPENDENT REGISTER Co.
3747 East 93rd Street • Cleveland, Ohio

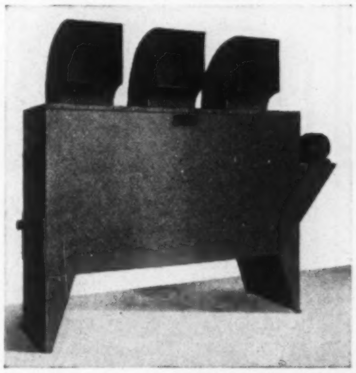
WE CAN DELIVER
within a reasonably short time

Our unit heaters are equipped with ALL STEEL Heating Elements. We have always standardized on ALL STEEL Elements, and therefore do not need to change our methods in spite of the war. Many years of experience and research are built into every model. Hundreds of American factories are efficiently heated by Airtherm Unit Heaters.



The AIRVECTOR
Propellor Fan Type Unit Heater

For floor and ceiling mounting, makes a highly efficient installation. Rugged construction. All-welded joints. Available in a complete range of sizes for any job. Quiet and efficient operation. Good heat distribution over large area.

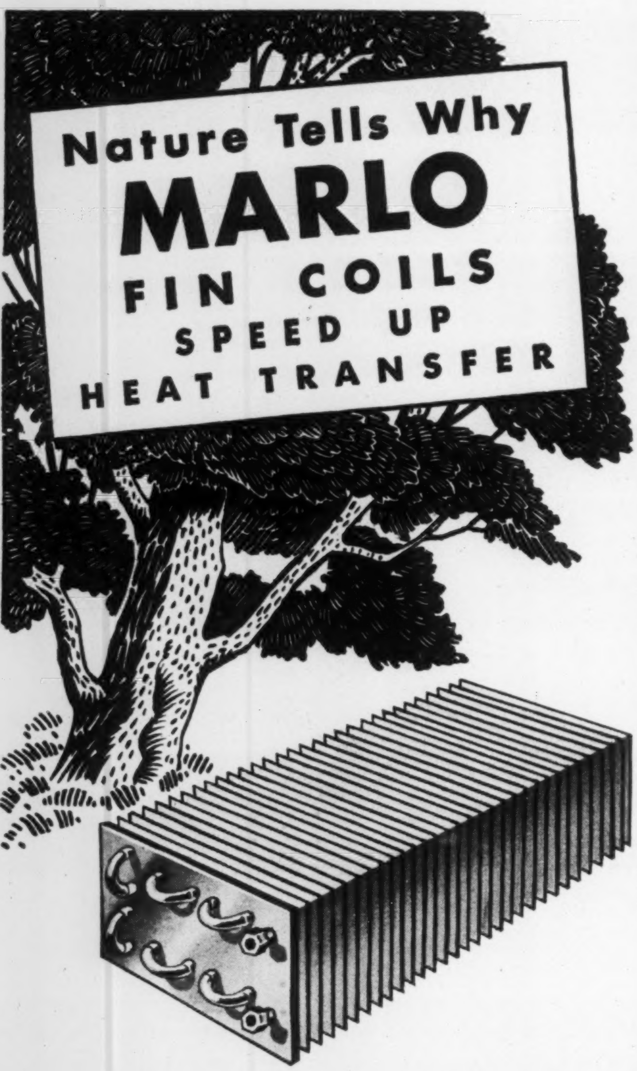


The AIRHEATOR
Centrifugal Fan Type Unit Heater

With many exclusive features in design and construction. Great resistance to corrosion, pressure and temperature. Airvector Unit Heaters have Ribbed Cabinets, greater rigidity, and eliminate vibration and "sounding board" action. Models are mounted with four-point saddle type suspension. Complete range of sizes for any job.

Write today for information.

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. ST. LOUIS, MO.



Why does a tree have leaves? For efficiency, not for beauty. Leaves increase the surface through which the tree gets water and air. Without leaves, a tree would die

The fins on Marlo Coils are like the leaves on a tree. They enlarge the surface through which the heat is transferred. This speeds up the process of heat exchange. That's one of the many reasons why Marlo Heat Transfer Equipment is preferred where efficiency counts. Ask Uncle Sam!

"MARLO MEANS
HEAT TRANSFER EQUIPMENT"

★ ★ ★

MARLO
COIL COMPANY
ST. LOUIS, MO.

enclosed in a sheath of durable asphalt that has a hig melting point. Its heat conductivity is 0.265 Btu per s ft per hr per F per in., at a mean temperature of 60 F according to the manufacturer.

It is made in the American standard size for refrigeration insulation, 12 in. by 36 in., and in thicknesses of 1, 1½ and 2 in.

The asphalt coating provides a substantially waterproof seal completely around the insulation. It also increases the stiffness and rigidity of the insulation so that the blocks can be used for the erection of self-supporting partitions, or as load bearing insulation to carry floors in refrigerated spaces. They can also be used as a promenade surface on flat roof decks.—Owens-Corning Fiberglas Corp., Nicholas Bldg., Toledo, Ohio.

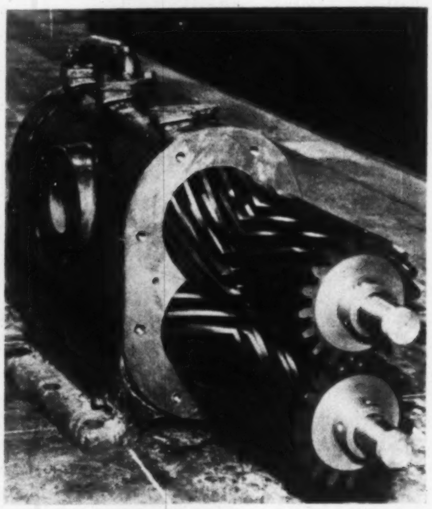
Soldering Bond With Aluminum

No. 2258—A new metal alloy, "Galvalloy," is reported by the manufacturer to obtain a perfect soldering bond with aluminum or aluminum alloys without the use of flux. It also is said to bond practically all types of metals, allowing the bonding of aluminum or aluminum alloys to these metals.

The alloy can be used for many purposes, such as in foundries where aluminum castings are made for filling blow holes or defects. It also can be used as a protective coating on welded seams or other areas where a noncorrosive coating is needed.—Metalloy Co., Box 3093, Terminal Annex, Los Angeles, Calif.

Micarta Gears for Compressors

No. 2259—Noise and vibration from 5 in. gears in the methyl chloride rotary compressors of the Professional building, Phoenix, Arizona, have been eliminated by the substitution of Westinghouse micarta gears. In addition to the increase in gear life there has resulted an increased tonnage capacity with a reduction in horsepower input, according to the manufacturer.



Compressors to air condition the building are rated 65 tons each and handle methyl chloride at 90 psi discharge pressure and 25 psi suction pressure. Glycerine is used as a seal between the gears to trap the methyl chloride. The gears are the product of the Johnson Gear and Mfg. Co., Berkeley, Calif.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 107. *If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to* HEATING, PIPING & AIR CONDITIONING.

Air Compressors

No. 4135—6 p. bulletin (H-621-B8) on vertical, single cylinder, single stage, air or water cooled air compressors, the former having capacities of 1 to 26 cfm and the latter 24 to 67 cfm. Construction features, specifications and selection tables are included.—Worthington Pump & Machinery Corp., Harrison, N. J.

Boilers

No. 4136—8 p. catalog (42) on automatic magazine feed heaters with capacities from 175 to 3600 sq ft steam, 290 to 5925 sq ft water. According to the manufacturer, these heaters offer great possibilities because of wartime restrictions on vital fuels. They require attention only once or twice a day, burn No. 1 buckwheat anthracite or small size byproduct coke. Fuel action is by gravity from the magazine to the sloping grates with no moving or mechanical parts.—Spencer Heater Div., The Aviation Corp., 164 Park St., Williamsport, Pa.

Boiler Level Controllers

No. 4137—New bulletin describing two improved types of controllers, a pilot operated and a rotary type. Use of the cantilever principle multiplies expansion and contraction in the tube by six to permit wide range of movement for valve motivation and to allow use of a smaller valve, says the manufacturer. Other products are also described, including a universal pulsation dampener for eliminating vibration of gages, thermometer wells, gas samplers and gage strips.—J. A. Campbell Co., 651 Wardlow Rd., Long Beach, Calif.

Electroplated Metals

No. 4138—"Defense sampler" chart for hanging on the wall, giving actual samples of prefinished (plated) metals, illustrating how they can help conserve strategic materials for vital war production. There is an interesting comparison chart illustrating the conservation of vital metals. Copies of this sampler are available to readers bidding on government contracts.—American Nickeloid Co., 113 Second St., Peru, Ill.

Evaporative Condensers

No. 4139—Three 2 p. leaflets presenting technical information on "Type 9Q" evaporative condensers for refrigeration systems and for cooling liquids in various industrial applications. A description of a compound for treating water to decrease the possibility of scale formation and corrosion of metal parts is included.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Freon for Low Temperature Work

No. 4140—8 p. technical bulletin giving the thermodynamic properties of "Freon-12" (dichlorodifluoromethane) at low pressures together with various other physical properties. Prepared by A. F. Benning and W. H. Markwood, Jr., this is a valuable and compre-

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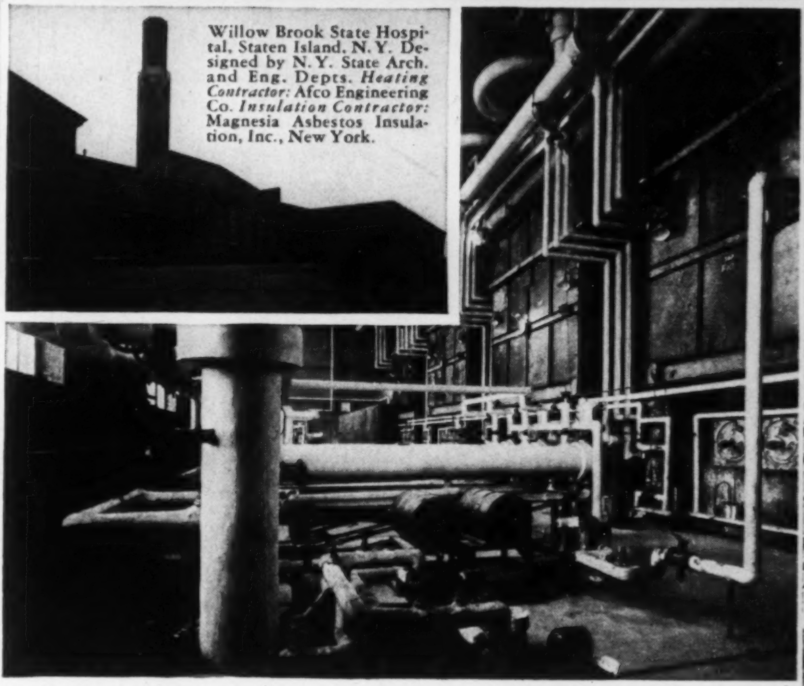

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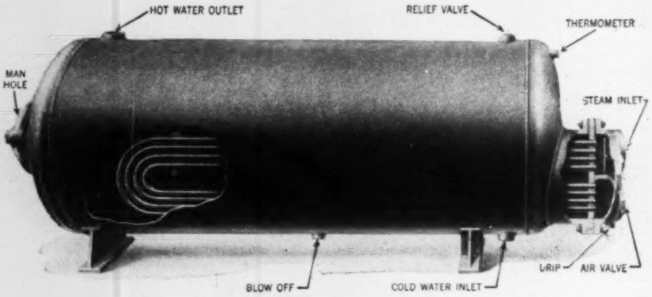

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hensive presentation with complete information.—Kinetic Chemicals, Inc., 10th and Market St., Wilmington, Del.

Industrial Rubber Products

No. 4141—Series of four pamphlets on how to get the most service out of industrial rubber products, designed to assist in the program of rubber conservation made necessary by war developments. There are separate pamphlets on transmission belting, conveyor belting, v belt drives, and belt salvage.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Lubrication

No. 4142—Issue of Lubrication (Vol. 28, No. 2) devoted to the relationship of air conditioning to rust prevention. The advantages of air conditioning metal working plants in order to prevent damage to finishes by rust is covered and there are sections on lubrication of air conditioning compressors, designing for lubrication, rust preventatives, etc. Also, issue of Lubrication (Vol. 28, No. 1) devoted to a discussion of the nature of the lubrication process and including valuable and fundamental data in both text and graphical form.—The Texas Co., 135 E. 42nd St., New York, N. Y.

Metal Duplicating Without Dies

No. 4143—32 p. catalog explaining the "Di-Acro" system of metal duplicating without dies, a process for duplicate forming of parts or pieces to die accuracy using precision machines individually and in cooperation with each other. Development of the system is described, and benders, brakes and shears are illustrated, as are parts

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Meters and Control

No. 4144—20 p. bulletin (16) designed to aid plant engineers faced with the necessity of meeting increased steam demands by operating boiler plants on a 168 hr per week schedule. Numerous suggestions—many of which can be carried out without the use of elaborate metering or control equipment—are made under the general headings of checking condition of boiler and furnace, checking operating procedure, possibilities for modernization, and the importance of basing daily operation on accurate measurements and records.—Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, Ohio.

Motor and Control Manufacture

No. 4145—32 p. catalog (A-3023) describing and illustrating the manufacture of motors and controls for general industrial use. Mass production of precision parts, multiple dipping and baking, foundry operations, assembly and testing, are among the procedures described and illustrated.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Pressure Recorders

No. 4146—32 p. catalog (22-A) arranged to save time in selecting the type of pressure recorder best suited to meet particular needs and covering instruments for the measurement and recording of industrial pressures of all kinds in ranges from 1 in. of water to 20,000 psi. In addition to construction features of the manufacturer's

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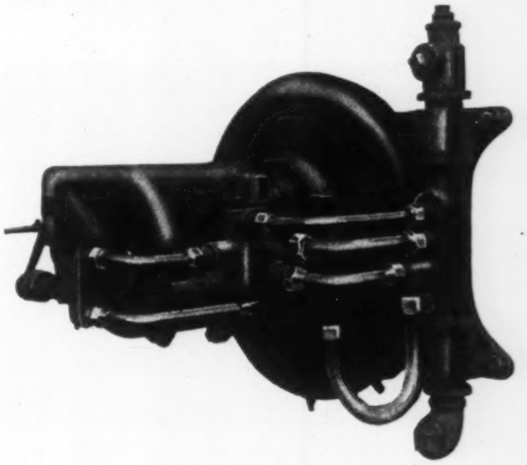

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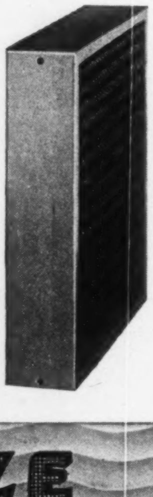

recorders, various types of pressure measuring elements are illustrated, there are full size reproductions of specimen charts, and descriptions of methods of instrument mountings, types of cases, electric signal systems and accessory equipment.—Foxboro Co., 106 Neponset Ave., Foxboro, Mass.

Pumps

No. 4147—4 p. bulletin (110) illustrating a new line of direct connected rotary pumps for capacities of 5, 10 and 20 gpm, and operating pressures up to 100 psi. Specifications are included.—Blackmer Pump Co., 1809A Century Ave., S.W., Grand Rapids, Mich.

Pump Units

No. 4148—36 p. catalog (B6018-B) on "SSUnit" and "Electrifugal" pump units with head capacity tables and dimension charts to use in selecting proper pumps for individual applications, performance data, and engineering recommendations, including cross section and construction details. The compact motor pump units and base mounted units described are built in a wide range of sizes and capacities from 10 to 2750 gpm and for heads to 575 ft.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Pyrometers

No. 4149—36 p. catalog (1101-G) on "Tag Celectray" electric thermometers and pyrometers, including photoelectrically balanced recorders, indicators, controllers and recording controllers. The instruments are described in detail and complete specifications are given.—C. J. Tagliabue Mfg. Co., 540 Park Ave., Brooklyn, N. Y.

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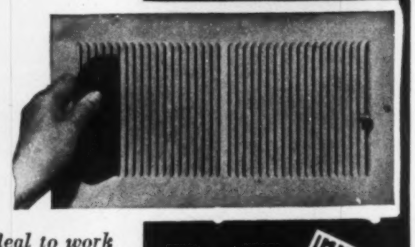

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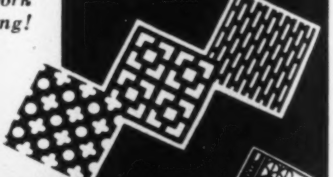

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No. 4150—8 p. bulletin (W-205-B9) on three stage steam ejectors describing applications, installations, testing and the various types available, with data on their operation.—Worthington Pump & Machinery Corp., Harrison, N. J.

Steam Traps

No. 4151—4 p. leaflet describing "Model 08" medium pressure and blast type steam trap, illustrating and describing features. Available in three sizes for capacities from 500 to 3800 sq ft EDR.—William S. Haines & Co., 12th & Buttonwood Sts., Philadelphia, Pa.

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No. 4152—16 p. bulletin (B6082-A) on "Vari-Pitch Texrope" sheaves for obtaining quick and accurate speed changing in order to increase machine flexibility. Stepless speed variation up to 25 per cent is obtained with one of these sheaves, and 50 per cent variation can be obtained by using two of them. Stationary and motion control sheaves are described and operating diagrams, sizes and dimensions are included.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Welders' Safety Protection

No. 4153—4 p. bulletin of products for safety protection for welders, including gloves, aprons, curtains, goggles, shields, etc.—Kimball Safety Products Co., 7314 Wade Park Ave., Cleveland, Ohio.

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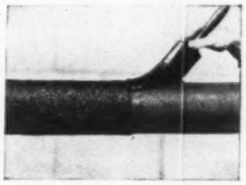

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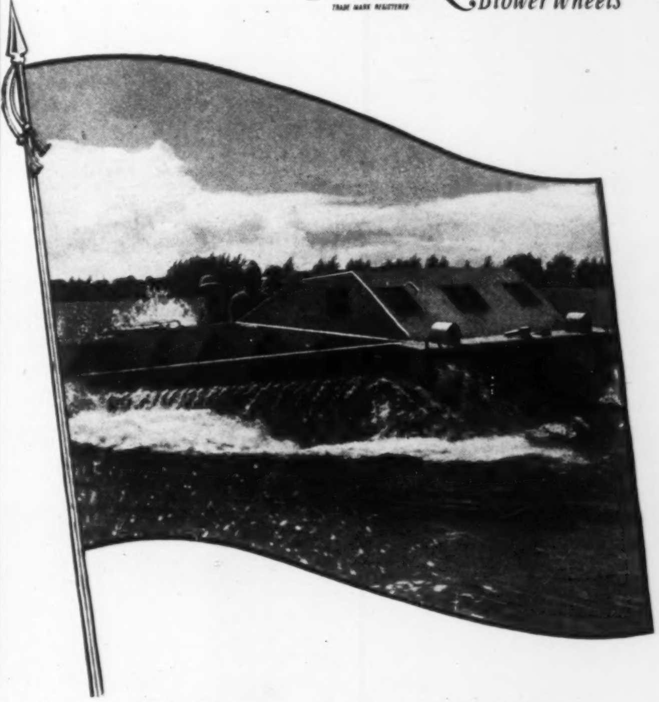

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Useful Information

New Text on Thermodynamics

Thermodynamics, a new text book by Joseph H. Keenan, professor of mechanical engineering at MIT, is outstanding both for its lucid writing and for the breadth of its treatment. It includes not only the standard subjects of thermodynamics which have usually been taught in conventional courses in mechanical engineering, but also subjects which have heretofore been taught only to chemical engineers. These latter are presented from the viewpoint of the mechanical engineer and their treatment is consistent with the treatment in the portions dealing with conventional mechanical engineering subjects. Such a consistent treatment makes it relatively easy for the mechanical engineer to obtain a rather good understanding of chemical thermodynamics.

Discussion of the conventional mechanical engineering subjects in this book is from a basic viewpoint. The various subjects, such as perfect gases, availability, turbines, fluid flow, refrigeration, etc., are treated in a fundamental and thorough manner. Not only is the fundamental thermodynamic theory developed in a clean-cut and logical manner, but—as an indication of the scope and modernity of the treatment—the cycle of both the "Electrolux" refrigerator and the silica gel adsorption machine are described, something rarely found in thermodynamic texts.

Considering the various types of problems with which the mechanical engineer is called upon to deal today, an

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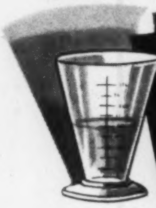

excursion into the field of chemical thermodynamics is of considerable benefit. For example, it is impossible for the mechanical engineer to have a thorough understanding of the absorption refrigeration system without an understanding of the theory of binary mixtures such as is given in this book.

This book is valuable not only as a text, but also as a reference in modern thermodynamics for the practicing engineer. It is safe to say that it will be something of a revelation to the practicing engineer who is still using for reference purposes a thermodynamics text written more than 10 years ago.

The publisher of this 500 p. volume is John Wiley & Sons, Inc., 440 Fourth Ave., New York City. The price is $4.50.

Mineral Wool Low Temperature Insulation

After formulation by its technical committee and approval by the engineering staffs of the principal mineral wool insulation manufacturers, the Industrial Mineral Wool Institute has adopted and released specification No. 1, Mineral Wool in Low Temperature Installations. The availability of unrestricted supplies of domestic mineral wool insulation makes America independent of imported insulation, according to the institute.

This 8 p., 8½ by 11 in. booklet includes material specifications, specifications for surface preparation of areas to be insulated, in addition to individual specifications for the application of mineral wool insulation on walls, floors, ceilings, piping, fittings, etc. Drawings illustrate approved methods of applying mineral wool insulation, providing the necessary vapor barrier, supporting and

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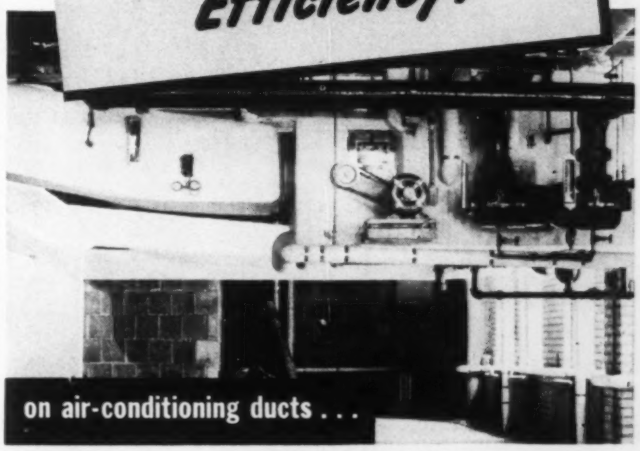

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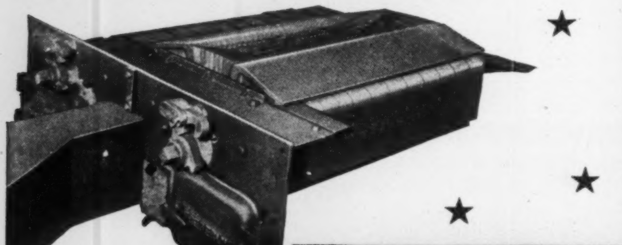

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finishing off the insulation in various applications. Copies may be secured without charge by writing to Richard L. Davis, secretary, Industrial Mineral Wool Institute, 441 Lexington Ave., New York, N. Y.

MTD Calculator for Figuring Heat Transfer

A mean temperature difference calculator has been devised to help in the approximation of heat transfer surfaces when preparing estimates or specifications for heat exchange equipment. Measuring 9 in. long by 4⅛ in. wide, it is made up of heavy paperboard with a varnish finish and operates like a slide rule.

The calculator includes scales for the calculation of the logarithmic MTD as well as the MTD correction factors for one, two, three, four and six shell passes, and also *C* and *D* scales which permit multiplication and division operations.

A limited supply of these calculators is for sale at 25c each by American Locomotive Co., Alco Products Div., Dept. F, 30 Church St., New York, N. Y.

War Courses for Draftsmen

The school of architecture and allied arts of New York University, 100 Washington Square East, New York City, has announced five intensive practical drafting courses in electric light and power, heating and ventilating, plumbing, structures (reinforced concrete, steel and wood), and ship construction. These courses will begin in April and will continue for 7½ weeks, meeting four nights a week, three hours a night.

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FOR THE FIRST TIME in the air conditioning field, a Presteel Fan Housing with the Venturi Section drawn down in one operation, is available as a standard item.

Increase the fan efficiency of your air conditioning system. Send today for the free folder and price list that give the full story of this new Commercial Fan Housing—its features, sizes and gauges available for exhaust fans, ventilating fans and unit heaters.

The COMMERCIAL SHEARING & STAMPING COMPANY
1775 LOGAN AVE. · YOUNGSTOWN, OHIO
THE FIRM THAT IS FAMOUS FOR TANK HEADS, CIRCULAR SHAPES AND PRESSED STEEL PRODUCTS

a marked shift in the requirement for drafting personnel. The scope and tempo of the building program calls for specialization, says the announcement.

The heating and ventilating course is to cover heating and ventilating materials; reference manuals; codes, laws, fire underwriters' regulations, trade practices; drafting symbols; boilers, heaters, fuel burning equipment; steam, hot water, air heating; heating defense housing, barracks, industrial plants.

Centrifugal Fans and Blowers

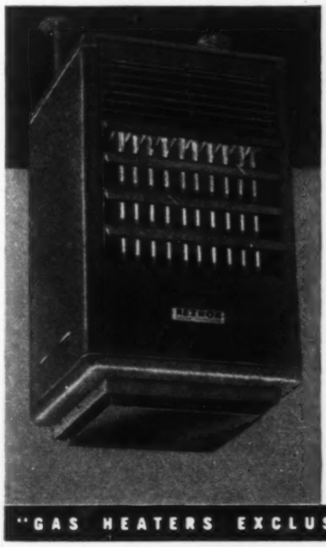
The third edition of Standard Methods Adopted for Centrifugal Fans and Blowers, published by the National Association of Fan Manufacturers, 5-208 General Motors Bldg., Detroit, Mich., is available from the NAFM on request.

The new edition, embodying the established working data of the association, has been completely revised and rearranged. There are included standards for multiblade and non-overloading types of fans, air density ratios at various altitudes and air temperatures for use with the chart on classes of fans, typical specifications, information on abrasion, field tests of fans, and comparison charts for industrial exhausters and cast iron volume fans.

A tabulation of fan sizes for multiblade and non-overloading fans, together with minimum recommended gages of steel for side and scroll, class I design, are again included but revised on the basis of the new standards.

REZNOR
GAS FIRED UNIT HEATERS

for "ALL OUT" INDUSTRIES



SAVE days and sometimes weeks in installation time by installing Reznor Suspended Gas Unit Heaters. The units are available and ideal for alterations and construction of defense factories. Only a gas line and electricity are required. Compared with cast radiation systems, they use 89% less vital materials. This alone means less delay. Send for catalog of Reznor's complete line NOW.

REZNOR MANUFACTURING CO.
305 JAMES STREET
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"GAS HEATERS EXCLUSIVELY SINCE 1888"

Heat air ducts ELECTRICALLY with this fume-proof, corrosion-resisting electric heating unit—

Ideal for use with blower type unit heaters, in air blast for process work, in ovens, dryers, etc.

CHROMALOX Electric

SEAMLESS FINSTRIP

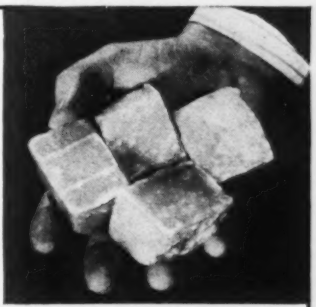
is supplied in steel sheath and fins for temperatures to 750 deg., monel sheath and fins for temperatures to 950 deg., and where corrosion-causing gases or moisture is present. Terminals can be protected by sealed cover or the unit so installed as to protect them. These units also come with mounting flange, for installation with terminals outside of duct or oven, and also for use in superheating steam. Made in lengths from 9 in. to 42½ in., wattages to 3500.

One of the many types of Chromalox units for industrial electric heat.

Many engineers keep the Chromalox Book of Electric Heat handy for instant reference. Write for your copy. In specific problems our expert engineering cooperation is yours at request.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh, Pa

FOR DRYING AIR or GASES



CALORIDE

WHAT "CALORIDE" IS—"Caloride" is an especially designed, patented form of moisture absorbing chemical produced in the shape of hard, fused solid blocks as shown above.

WHAT IT DOES—Upon exposure to air, "Caloride" cubes attract moisture, gradually diminishing in size as moisture is absorbed. Due to their patented features, "Caloride" cubes retain their form until they are entirely dissolved—thus permitting free and continuous circulation of moisture laden air or gas through a suitable container filled with cubes.

WHERE USED—"Caloride" is used wherever there is a need for control of excessive humidity. "Caloride" prevents condensation and ends mold, mildew and other damage caused by excessive moisture in air. Its use is not restricted to any particular size or type of equipment—it is being used in commercial units handling large volumes of air as well as in small equipment designed for more limited application.

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SOLVAY SALES CORPORATION • 40 Rector Street, New York, N. Y.
Please send complete details on "Caloride"—including prices, packages, new folder "Caloride For Drying Air or Gases."

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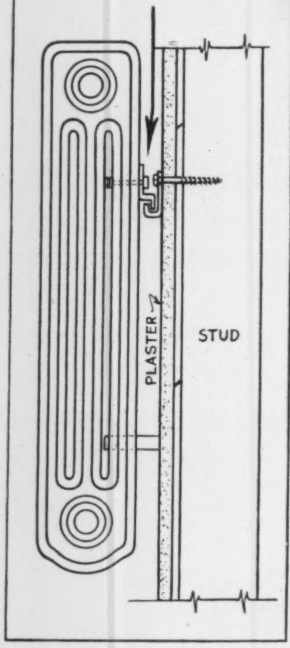
Affiliated with ____________________

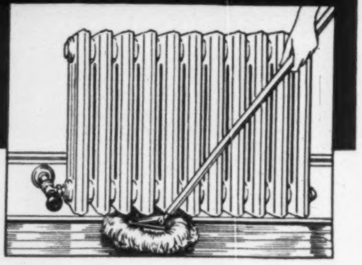
Address ____________________

City ______________ State ______________ 95-442

NOW READY!
B & G RADIATOR HANGERS

Top of radiator is anchored securely to the wall ... spacer and piping connections at the bottom of the radiator prevent swinging in or out.





All clear floor space wnen radiators are hung this modern way

New easier way to hang radiators on the wall! Patented B & G Radiator Hangers fit all modern tube radiators ... permit greater flexibility in roughing-in ... carry more weight. Ideal for Army and Navy barracks!

Use B & G Radiator Hangers for easier cleaning and a better pleased customer.

Distributed everywhere by leading wholesalers

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MORTON GROVE, ILLINOIS

NEVER HARDENS...
PIPES ALWAYS EASY TO DISJOIN

Rutland is the Pipe Joint Cement that master plumbers swear by—not at. It seals joints tightly—lasts indefinitely. Saves money because more bulk per pound. Legal for use in all cities because no toxic ingredients. Remains soft in can. Does not stain hands or fixtures.

Mail post card for free sample. Rutland Fire Clay Co., Dept. H-4, Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patcher.

RUTLAND
PASTE PIPE JOINT CEMENT
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RUTLAND, VT.

Coming Events

Midwest Power Conference: April 9-10, Palmer House, Chicago, Ill. Sponsored by Illinois Institute of Technology, other midwestern universities and colleges, and local sections of engineering societies. Charles A. Nash, conference secretary, c/o Illinois Institute of Technology, Chicago, Ill.

Industrial Health Defense: 27th annual meeting, American Association of Industrial Physicians and Surgeons, and third annual meeting, American Industrial Hygiene Association, April 13-17, Hotel Gibson, Cincinnati, Ohio. Hazards to the health of war workers, arising from the expanding production program, will be discussed. Subjects to be covered include the ventilation requirements for radium dial painting, by W. C. L. Hemeon and R. D. Evans; ventilation and dust problems associated with deep tunnel operations in Colorado (moving picture and talk), by R. J. Owens; inhibitor mechanisms against the action of free silica, by L. U. Gardner; recognition of toxic effect upon workmen exposed to toxic materials, by John Foulger; and lead poisoning (a symposium). For further information, write Industrial Hygiene Foundation, 4400 Fifth Ave., Pittsburgh, Pa.

Foundry Convention and Show: 1942 "win the war" convention and show, April 20-24, Cleveland, Ohio. American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

Heating, Piping and Air Conditioning Contractors National Association: 53rd annual convention, May 25-27, Hotel Schroeder, Milwaukee, Wis. Reports are to be given on operation of the contractor's shop today under the regulations imposed by the War Production Board, how to sell repair modernization, how to get materials, relations with the government, certification of welders, standards, air conditioning, apprenticeship, etc. George J. Stoehr is chairman of the local convention committee. Headquarters office of the HPACCNA, is at 1250 Sixth Ave., New York, N. Y.

American Society of Refrigerating Engineers: Spring meeting, June 7-9, Skytop Club, Skytop, Pa. Discussion of expansion of air conditioning of blast furnaces is among the subjects planned for the program. Headquarters office of the ASRE is at 50 W. 40th St., New York, N. Y.

National District Heating Association: Annual meeting, June 11-12, Dayton Biltmore Hotel, Dayton, Ohio. Headquarters office, 827 N. Euclid Ave., Pittsburgh, Pa. John F. Collins, Jr., is the secretary.

American Society of Heating and Ventilating Engineers: Summer meeting, June 15-17, Hotel St. Paul, St. Paul, Minn. For further information, see ASHVE Journal Section. Secretary of the ASHVE is A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

American Society for Testing Materials: 45th annual meeting, June 22-26, Atlantic City, N. J. Headquarters office of ASTM is at 260 S. Broad St., Philadelphia, Pa.

The Romance of Outstanding Industries

WE'VE ALL *listened to radio broadcasts, but few of us have the opportunity of seeing the script which keeps everything running so smoothly at split-second timing. Here's the script [translated from the Spanish] for a 15 minute Pan American broadcast on air conditioning over WRCA and WBOS on May 1:*

(SUITABLE BARS FOR OPENING FROM FIRST SYMPHONY "EL GUARANI" 7890-B. FADE FOR)

ANNOUNCER: (OVER MUSIC) In our daily life we take for granted a multitude of things that are the fruit of the work and genius of mankind through whole generations and which often include true miracles. To draw near for a moment to the shops, mills and factories where these marvels are brought into being for our comfort or enjoyment, the Export Managers Club of New York, in collaboration with NBC, presents each Friday at this same hour a program which we are confident will interest our listeners:

The Romance of Outstanding Industries

(PAUSE)

Tonight we discuss *CONQUERING THE TEMPERATURE*

(MUSIC UP FOR FIVE SECONDS—EITHER HAMMOND ORGAN OR PIANO—AND THEN OFF FOR ANNOUNCER, COLD)

The scene is Venice to which Marco Polo, tireless explorer, has just returned after visiting strange and distant places far from the Queen of the Adriatic. His friends have come to visit him. In the Reception Room Bagarochi and Della Piazza, city officials, are talking . . . .

BAGAROCHI: Friend Della Piazza, I never miss one of these meetings at Marco Polo's salon. His fables fascinate me, his stories entertain me more than a concert, and his lies dazzle me.

PIAZZA: Lies? Fables? I came here to gather from the lips of the illustrious voyager, who is one more glory for Venice, treasures of wisdom. His parlor is a cathedral, friend Bagarochi.

BAGAROCHI: But do you believe all that assortment of lies that he tells us through the protection of his venerable beard? They are absurd. . . .

PIAZZA: They are the fruits of his extensive wanderings.

BAGAROCHI: They are the fruits of an over-heated imagination. Who can deny what he says about Asia and China and countries which he claims to know intimately, but where he alone has been . . . without witnesses!

PIAZZA: Friend Bagarochi. . . .

MARCO POLO: (COMING TO MEET THEM) My dear Della Piazza! My esteemed Bagarochi! Welcome to my humble home. Come along! Come along! Tonight we will have good company . . . the cardinal . . . (FADE)

(SOUND OF SEVERAL GUESTS TALKING IN THE SALON .

THEN MARCO POLO, DELLA PIAZZA AND BAGAROCHI GREETING THE REST OF THE GUESTS AD LIB. THEN NOISES OF CHAIRS PULLED AROUND THE HOST. COUGHS, ETC.)

CARDINAL: It certainly has been warm. It is positively suffocating.

MARCO POLO: It is a shame that I could not install here a system like the one used by the natives of that torrid island of Ormuz. . . .

BAGAROCHI: (ASIDE) Well, here goes our Marco Polo.

PIAZZA: (ASIDE TO BAGAROCHI) Friend Bagarochi, prudence and silence.

BAGAROCHI: (ASIDE) I shall listen to the fable of the island. (ALOUD) Go ahead, Marco.

CARDINAL: Where is the island of Ormuz?

MARCO POLO: In the Persian Gulf, where the air itself seems charged with fire, where the breezes seem to be the breath of hell. To defend themselves from that unbearable heat, the natives build a kind of tunnel in the roofs of their houses, which ventilates them so that the air in the interior of their houses is cooler than outside.

BAGAROCHI: But that is absurd! That cannot be done!

MARCO POLO: It may appear absurd to you, friend Bagarochi, but I assure you that it is a real pleasure to protect one's self from the heat. In India there is another system. . . .

CARDINAL: Were you in India, too?

MARCO POLO: I travelled along the borders. In this 13th century in which we live we Europeans are not aware of the progress which some Asiatic peoples have made for their own comfort.

PIAZZA: I think I read somewhere that the Egyptians, 500 years before Christ, had that system of ventilating tunnels that you mention, Marco.

MARCO POLO: The system of the Indian potentates is different. On the porches of their marble palaces they hang mats soaked in water. The air, on blowing through, is cooled and it cools the entire room.

MURINI: I have seen in my hives that the bees have their own special ventilating system.

PIAZZA: That is most interesting, friend Murini. How?

BAGAROCHI: (ASIDE) Lying is contagious. The fables of Marco Polo have invaded the bee hives of Murini.

PIAZZA: (ASIDE) Quiet, please, Bagarochi.

MARCO POLO: How do your bees ventilate their hives, Murini?

MURINI: Suspended from a given point in the hive, they beat their wings rapidly and blow currents of air hither and yon.

BAGAROCHI: How absurd! Insects overcoming heat better than we Venetians do! (FADES AS VOICES BECOME CONFUSED)

ANNOUNCER: (COLD) But this was not absurd, nor did Marco Polo speak fables to his friends. The fundamentals of air conditioning were known and practiced in ancient times by Egyptians, Persians and Hindus. The principle on which temperature control is based has not changed. It has simply been modified, perfected and extended in modern times.

(PIANO MUSIC TO BRIDGE—UP 5 SECONDS AND FADE)

OLGA: (OVER MUSIC) This heat is intolerable and there is no way of overcoming it . . . and I am so stuffed with vanilla ice cream and ices . . . and my arm hurts from fanning myself so much.

JULIO: Well, let's go into the movies. Here, this one seems cool.

OLGA: That's a fine idea, even though the film isn't so good. It is a shame the streets aren't cooled by refrigeration.

JULIO: Do you know that wells and the corridors of mines are cooled by refrigeration?

OLGA: Inside the earth?

JULIO: Inside the earth. In Africa, where the heat is even worse than it is here, a friend of mine, who is head of a group of miners, told me that the entire mine was air conditioned so that working conditions would be better and there would be no risk of collapse at the fantastically high temperatures. It is one more blessing of a new science. In New York, 1200 feet above the street, a skyscraper is air conditioned. In Africa, 7500 feet underground, a mine is air conditioned.

OLGA: And here in the movies, the same thing. Come, let's go in!

(MUSIC UP FOR 5 SECONDS AND THEN OFF ENTIRELY)

ANNOUNCER: (COLD) Most people think that air conditioning, which some call man-made weather, is simply a system to help us bear the excessive summer heat. This is not so. Air conditioning is one of the indispensable factors in a multitude of modern industries, because it has four definite purposes: Cooling

THE EDITOR'S PAGES

the air, dehumidification (that is, removal of moisture from the air), circulation and cleaning of the air. *In modern warfare* air conditioning is *essential.* Let us listen to an army Colonel talking to his Quartermaster. . .

COLONEL: Is all the ammunition ready for shipment this afternoon on the military trains?

FOSTER: Everything is ready and in excellent condition, in spite of the fact that it has been stored several months.

COLONEL: What bothers me isn't so much the armaments and the explosives. The Brigadier sent me an official communication about the effectiveness of bombs and hand grenades. But the blankets, the replacement uniforms . . . after so much time in storage. . .

FOSTER: The storeroom, like the warehouse where the ammunition is kept, is air conditioned. The woolens are kept in perfect condition, as are the shoes. Everything is just as it left the factory.

COLONEL: Good, Foster. You may go.

(MUSIC OF PIANO UP 5 SECONDS AND THEN OFF ENTIRELY)

ANNOUNCER: (COLD) The control of temperature, humidity, and air cleanliness is permitting the manufacture of many useful articles, quite aside from protecting the health of the workers in the factories and mills. In fact, rayon, nylon, and similar man-made textiles could not be made without air conditioning.

(SOUND EFFECTS OF TEXTILE MILL AT WORK—5 SECONDS AND FADE FOR)

BENEDET: (OVER SOUND) To properly manipulate many metals, to keep the expansion of metals from affecting the calibration in diameter of the parts that make up airplane and tank engines and other precision machinery—the air must retain a predetermined amount of humidity and the temperature must be uniform and exact. In this way, air conditioning influences delicate mechanisms essential to the demands of modern wartime and modern peacetime.

(SOUNDS CEASE. PIANO CHORD FOR 3 SECONDS UP AND OFF)

HAZERA: Perspiration, which is acid and inevitable in excessive heat, damages metals. For this reason, in factories making precision instruments such as clocks, rifle and cannon sights, compasses, optical apparatus, airplane and naval instruments, cameras and other delicate products, air conditioning is essential.

(CHORD)

CARVAJAL: Telephone service is better when it involves a switchboard which is air conditioned, because humidity and excessive heat affect electrical connections and contacts. Air conditioning is also used in the manufacture of telephone apparatus and in producing the tremendous quantities of radio equipment required by the modern army, navy, and air force.

DE LEON: Air conditioning is indispensable for storing metals so that they may not lose their properties; also in keeping wood that is intended for special uses—for instance, in building airplanes.

(CHORD)

BENEDET: Most medicines, bandages, serums, and other pharmaceutical products in hospitals and drugstores must be manufactured and then stored at uniform and proper temperatures and humidities and in clean air, for full effectiveness. This is also true when such articles are kept on battlefields for emergencies.

(CHORD)

HAZERA: Air conditioning is essential not only to preserve war equipment and ammunition. Fuses, explosives, shells, bombs, and the arms themselves, may be manufactured effectively, and safely only under proper conditions of temperature and humidity. To carry on their work, the cartographers, military engineers and topographers who march with the military posts must have paper and lithographic material which have been processed under controlled air conditions.

(CHORD)

CARVAJAL: And air conditioning must be used in warehouses and throughout the manufacture of synthetic rubber, nitrates, fermented fruits, foodstuffs, and other factors of elementary strategy for the equipment, transportation, feeding, and arming of troops in the field.

(MUSIC UP FOR 5 SECONDS AND THEN OFF ENTIRELY)

ANNOUNCER: (COLD) Air conditioning improves manufactured products, lowers the cost of their production, and exercises a favorable influence on the health of the personnel...... in ......

BENEDET: In cigarette factories......

HAZERA: In candy factories......

DE LEON: In showrooms......

CARVAJAL: In shoe factories......

BENEDET: Wherever beef is slaughtered......

HAZERA: In the great factories that preserve foods....

DE LEON: At storage centers for vegetables and fruits ......

CARVAJAL: In war......

BENEDET: In submarines, to keep the temperature livable......

DE LEON: In munitions dumps, because bombs and shells should be kept in dehumidified store rooms..

CARVAJAL: In armament factories, because metals and explosive chemicals are sensitive to heat and humidity......in airplane and other munition factories which must be "blacked out" to avoid damage by enemy bombers.

(PIANO MUSIC UP 5 SECONDS AND THEN OFF)

GANDERO: (COLD) We have come a long way from the ventilating systems of the Egyptians, Persians, and Hindus, of which Marco Polo spoke to his friends . . . very far, too, from the primitive systems which man, imitating the bees in their hives, designed to ventilate and cool his rooms. Science has brought refinements which reach even to the clinics where sick people seek health.

BENEDET: The first hospital with air conditioning from the basement to the roof is in Mexico, where, for the first time, an institution has been equipped throughout to control and govern the temperature of the air.

GANDERO: . . . Even the kitchens of millions.

DE LEON: The household mechanical refrigerator is a manufacturer of artificial climate.

BENEDET: A brewer, Robert Portner, noted that in the dog days his beer—which was excellent—lost much of its flavor and even gave off disagreeable odors. Convinced that it was necessary to purify the surrounding air, he installed tubing containing ice, across which passed a current of air that cooled the atmosphere. The beer, as a result, preserved its flavor and its qualities.

HAZERA: On that system which had previously been conceived by Dr. Gorrie in Florida are based today's air conditioning systems.

(MUSIC UP FOR 5 SECONDS AND OFF)

ANNOUNCER: (COLD) This program has been presented by the manufacturers of air conditioning and refrigerating machinery in the United States to their associates, clients and other friends throughout the American continent, with the greetings and good wishes of those who have sponsored it. This cordial greeting is sent to you through this trade group: The Air Conditioning & Refrigerating Machinery Association in Washington.

(MUSIC UP FOR 5 SECONDS AND FADE)

ANNOUNCER: (OVER MUSIC) Another program relative to contemporary industries will be broadcast next Friday at this same time and on this same station, under the auspices of the Export Managers Club of New York. At 10:15 (New York Time) the program is repeated by station WBOS. (PAUSE) This is the Pan American Network of the National Broadcasting Company, Radio City, New York.

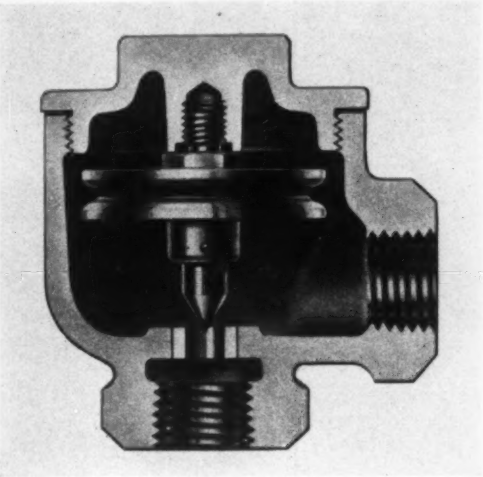
THE EDITOR'S PAGES

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1942, Heating, Piping & Air Conditioning *and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed*

Thermostatic Radiator Trap

No. *2260*—A new design of thermostatic radiator trap, intended to effect a maximum saving in critical materials and machine tool hours, is called "Old Ironsides", after the historic war craft. This name is appropriate not only because the trap is intended to meet a war need but also because iron is used for body and cap, and iron traps are not new to its manufacturer, having been in regular production more than 20 years ago.



Machine tool hours, needed so urgently for ordnance production, are saved through elimination of the nut and nipple. Brass—formerly used in the body, cap, nut and nipple—is conserved.

This trap will be available in ½ in. angle body only, with female tappings both ends. The outlet tapping will in all cases be standard right hand thread. The inlet tapping will be a left hand thread, to be connected with the radiator or other unit by using a right and left hand steel or iron nipple. On special order, a right hand inlet tapping will be provided.

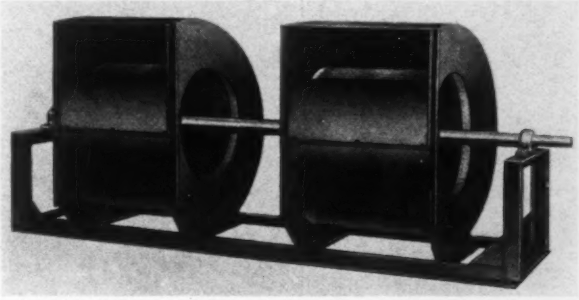
The little extra effort by the steamfitter involved in making the connection with a right and left hand pipe nipple will effect an important contribution to the cause of winning the war by saving brass, machine hours and cost, says the maker; thousands of radiators were installed in this way years ago.

The new trap has the same double diaphragm of monel metal or phosphor bronze and the same 60 deg cone valve piece and sharp edged seat as other of the manufacturer's traps.

Nickel and other plating has also been eliminated in the design; the trap is furnished in natural finish for painting after installation.—Warren Webster & Co., 17th & Federal Sts., Camden, N. J.

Motor Blower Units

No. 2261—Production of a new line of motor blower units in a wide range of sizes, applicable to industrial and commercial ventilating, drying, heating, cooling, exhausting, processing and air conditioning requirements, was announced last month. Available in 16 models, they are produced in one, two and three fan assemblies to meet resistances up to 4 in. SP and in capacities from 880 to 42,600 cfm. Fan speeds range from 300 to 1750 rpm. They may be secured with or without casings. They are belt driven or direct connected.



The units are available in two series of fan designs. "Series 1100" gives large volumes of air with quiet operation at low fan speeds for static pressures up to 1½ in., and "Series 1200" meets the resistance of duct systems and special conditioning equipment, protecting motors from overload by a retarded horsepower curve, for static pressures up to 4 in., the maker states.—Niagara Blower Co., 6 E. 45th St., New York, N. Y.

For Your Convenience

[5-42]

Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature." (*Circle each number in which you are interested*):

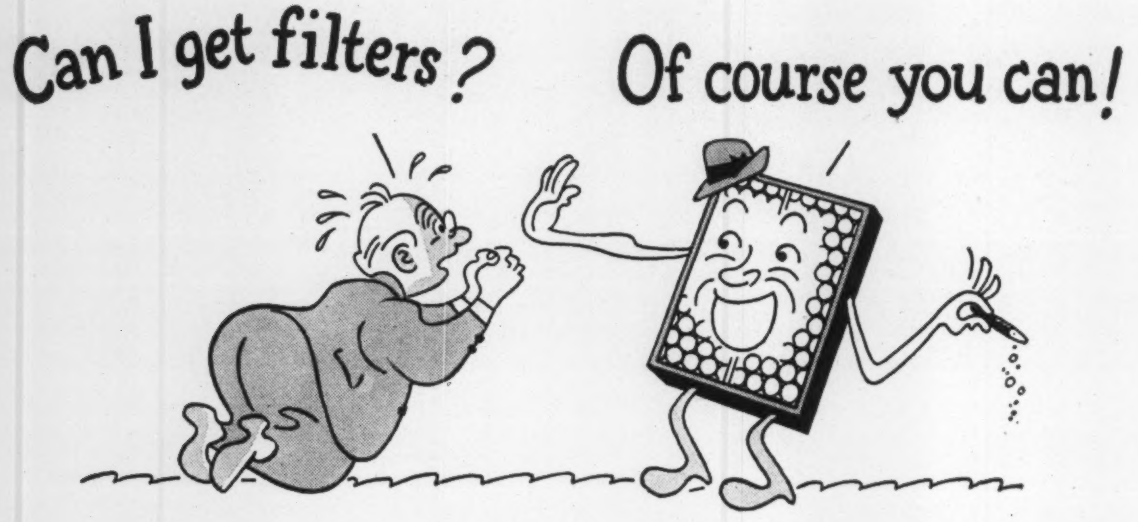
2260 2261 2262 2263 2264 2265 2266 2267 2268 2269
2270 2271
4154 4155 4156 4157 4158 4159 4160 4161 4162 4163
4164 4165 4166 4167 4168 4169 4170 4171 4172 4173
4174 4175 4176 4177 4178 4179 4180 4181 4182 4183

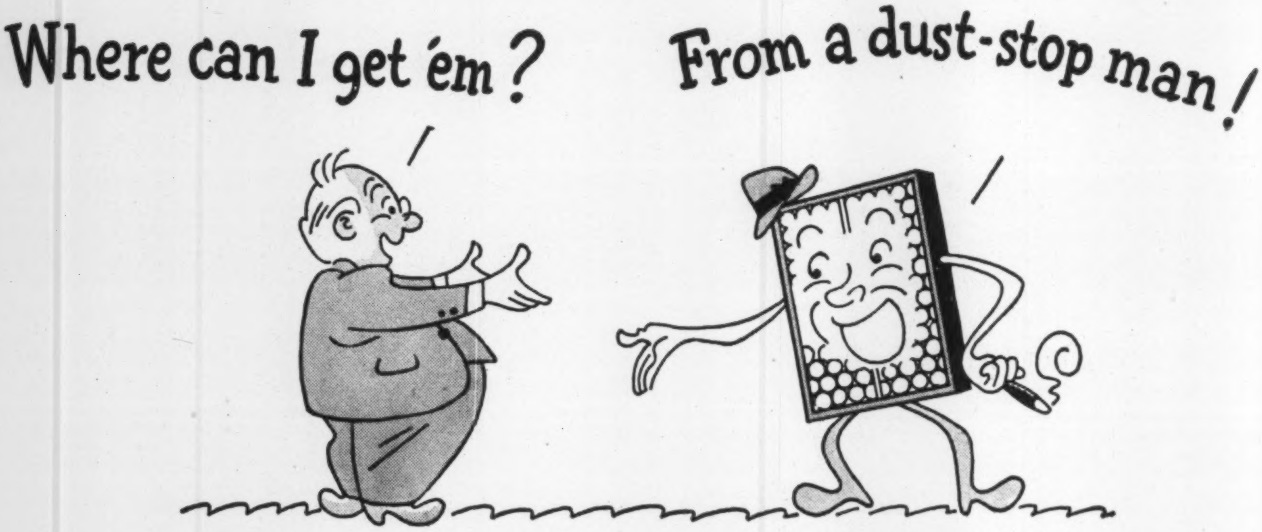
Name.................................... Title...............

Company ....

Address ....

City.................................... State...............


Can I get filters?
Of course you can!


Where can I get 'em?
From a dust-stop man!

FIBERGLAS* DUST-STOPS* —THE PRIORITY-FREE AIR FILTERS— DELIVERED WITHOUT DELAY!

PRIORITIES HAVEN'T STOPPED the manufacture of Fiberglas Dust-Stops—Dust-Stops are made from 100% American materials. Our laboratories have already developed replacements for critical materials that were previously used —*without the slightest sacrifice in Dust-Stop quality!* Production is proceeding with no bottlenecks. Deliveries are as speedy as they always were. When you order Dust-Stop Filters, you get them . . . any amount you want . . . any time you say!

With Dust-Stops Comes All This

Efficiency—and how! Their capacity: 2 CFM per square inch of area at 300 FPM. Average resistance, new, in inches of water gauge: .062 for 1-inch, .13 for 2-inch.

Fire-safety. Dust-Stop filtering material can't burn . . . it's *glass*. Adhesive is non-combustible.

Changing Dust-Stops is as easy as putting a new blade in your razor. Anyone can do it.

Money-saving is something Dust-Stops feature. Only 1¢ per CFM to install, 1/10¢ per CFM to replace. And Dust-Stops can be cleaned simply by tapping gently or vacuum-cleaning the face of filter. This procedure can be repeated once or twice where dust concentration is unusually high.

Who Carries Dust-Stops? Your air-conditioning manufacturer, jobber or dealer. Or write us. You can get No. 1 (1-inch), No. 2 (2-inch.) Pick up the phone and order Dust-Stops now.

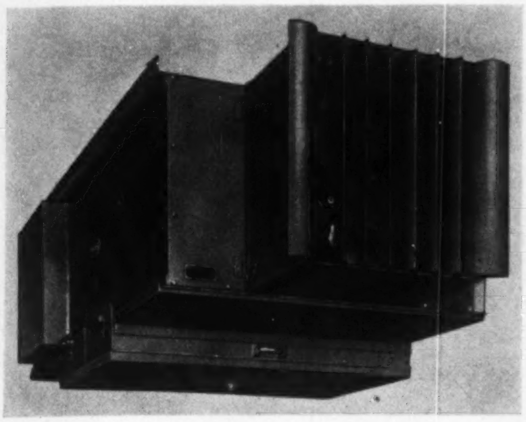
FIBERGLAS* DUSTOP* AIR FILTERS

*T.M. Reg. U.S. Pat. Off.

Made by Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, write to Fiberglas Canada, Ltd., Oshawa, Ontario

Industrial Humidifier Unit

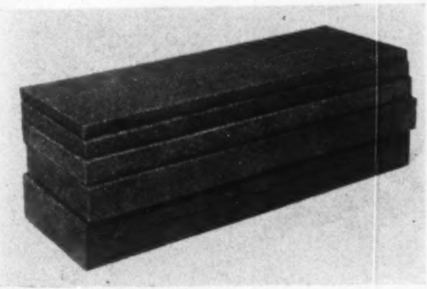
No. 2262—A new industrial humidifier is now available for textile mills, paper and printing plants and other industries where control of humidity is important in manufacturing, or for the storage of hygroscopic materials such as chemicals, leather, etc. The unit is compact, easily installed and low in power consumption, says the maker. It may be moved readily to accommodate equipment layout changes.



Available in two capacities, it will provide 4800 or 6150 cfm of humidified air and evaporate up to 96 lb per hr of water. The unit cleans, circulates and heats the air during winter. In summer it may be operated to provide evaporative cooling, cleaning and uniformly circulated air.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Nonpriority Board Insulation

No. 2263—A mineral wool board type of insulation for cold storage rooms and equipment has been introduced as a permanent addition to the manufacturer's line of low temperature insulation products. This new insulation is a nonpriority material and is available for all kinds of installations, it is announced. It equals or exceeds federal specification HHM-371 for board or block form insulation, having a thermal conductivity as determined by tests of average material produced ranging from 0.31 to 0.33 at 90 F, the maker says.

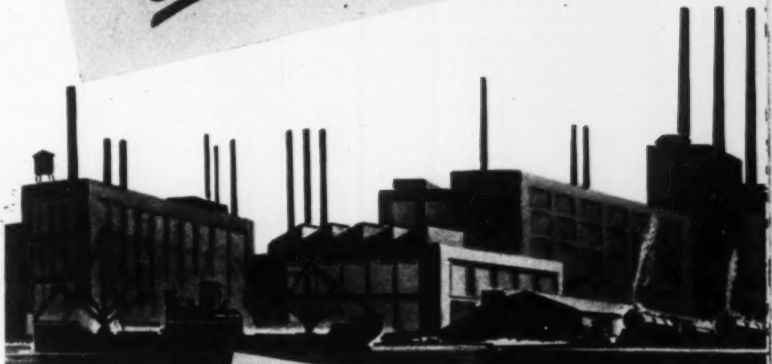


Manufactured in board size of 12 x 36 in. and in thicknesses of 1, 1½, 2, 3 and 4 in., this board is applied essentially the same as corkboard. Erection in hot asphalt with multiple layer construction is recommended by the manufacturer. The material may be finished with asphalt plastic or portland cement plaster.—Armstrong Cork Co., 994 Concord St., Lancaster, Pa.

Radiator Wall Hangers

No. 2264—The new "B & G" radiator hangers have three important features, according to the manufacturer.

UNFAILING POWER for UNINTERRUPTED PRODUCTION



TODD
COMBUSTION UNITS

• Is your power plant geared to the all-out war effort . . . the demands of the new 168-hour week?

ALL-OUT, America! The task is huge . . . the time short! To produce the staggering quotas now called for, your power plant must operate WITHOUT INTERRUPTION — AT TOP CAPACITY — and with MAXIMUM EFFICIENCY!

In plants of every type throughout the country, Todd installations, specially engineered to meet individual problems in the firing of liquid and gaseous fuels, are hitting new highs in efficient power production—under gruelling conditions. Todd technical-service staffs assure smooth, trouble-free operating performance . . . are instantly available in any emergency with parts and replacements from complete stocks in convenient key cities.

Whatever the size of your plant, Todd engineers will gladly confer with you on your combustion problems.

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Combustion a Problem?

Knowledge of combustion problems as applied to Heating and Power Boilers, plus the type of Burner Equipment used, either standard or special, enables Webster to solve any gas combustion problem.

The services of Webster Combustion Engineers are always available to individuals and organizations desiring consultation and assistance concerning gas burning installations.

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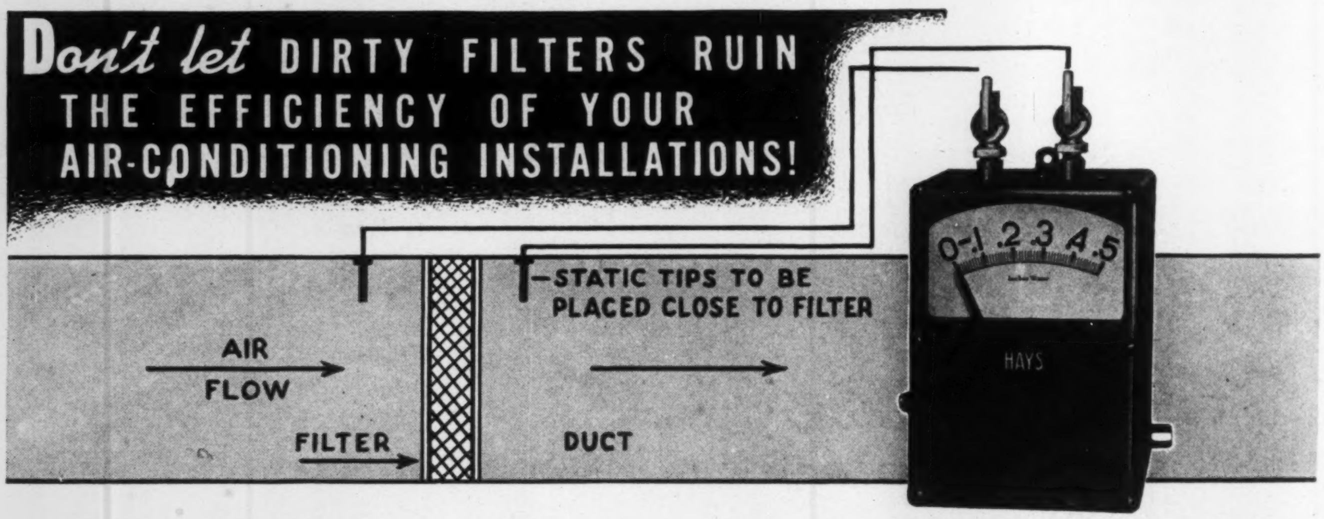
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION TOLEDO, OHIO

Don't let DIRTY FILTERS RUIN THE EFFICIENCY OF YOUR AIR-CONDITIONING INSTALLATIONS!

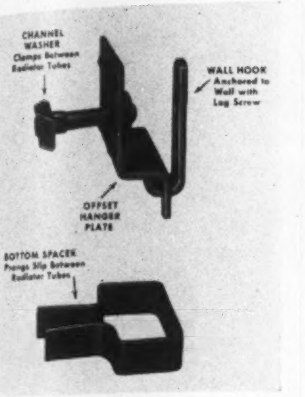


Dirt clogged filters in any air-circulating system mean reduced efficiency and added power costs. On the other hand, changing filters oftener than necessary is downright waste.

With a HAYS Air-Filter gage installed in a duct you know precisely, at all times, the condition of the filter and Static tips, installed on either side of the filter bank supply a differential air-flow measurement which is indicated on a scale in the remotely mounted gage. If desired, the gage may be made to flash or sound an alarm when filter resistance becomes excessive. And it is also furnished when wanted with electric contacts to operate a damper to control the flow of air through the duct.

The HAYS Air-Filter Gage employs the famous slack-leather diaphragm pressure measuring element and is of the high quality in design, materials and workmanship that has made Hays Gages internationally famous. The price is reasonable. Write us at 990 Eighth Avenue for Publication 40-278.

The HAYS CORPORATION
COMBUSTION INSTRUMENTS AND CONTROLS
MICHIGAN CITY INDIANA U.S.A.


CHANNEL WASHER Clamps Between Radiator Tubes
WALL HOOK Anchored to Wall with Lag Screw
OFFSET HANGER PLATE
BOTTOM SPACER Prongs Slip Between Radiator Tubes

They fit any modern tube radiator, with no allowance needed for rods; have greater adjustability, providing more flexibility on roughing in dimensions; and are able to hold more weight because of shorter leverage.

There are three models available, the first incorporating an expansion rest for masonry walls, the second having a wall hook which is bolted to the wall and the third being a ceiling radiator hanger. The first model permits adjustment at both top and bottom of the radiator for desired distance from the wall. The second model holds the radiator about 1¾ in. from the wall, and is nonadjustable.

According to the manufacturer, these hangers have been tested and shown to be capable of safely supporting up to 1500 lb.—Bell & Gossett Co., Morton Grove, Ill.

Static Discharging V Belts

No. 2265—New lines of static discharging and oil resistant v belts recently introduced are now being carried in stock in all popular sizes of A, B and C cross sections. Previously the belts had been made only on special orders. These static discharging belts are particularly useful in reducing hazards in many segments of war industries, including powder and chemical plants.

The static discharging v belt accomplishes its function through the use of a rubber in the belt covers which is so compounded as to actually conduct electricity. Static charges are not built up because the electricity flows continuously through the belt to the sheave and out through the frame of the machine. When the machine is grounded, no possibility of sparking is present, the maker states.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Blackout Board for Factories

No. 2266—A new blast cushioning, incombustible glass fiber material for blacking out war production plants is designed to reduce damage from concussion and to provide protection against the spread of fire caused by incendiary bombs or explosives.

Known as "Fiberglas OC-9" board, the material is composed of fine, resilient glass fibers compressed and treated with a binder which gives it sufficient rigidity to serve as a self-supporting, fire resistant material, which can be faced with glass fiber cloth, plywood, or other surfacing materials, says the manufacturer.

Where large window areas are to be covered for the duration of the war, use of glass fiber blackout materials can save 60 to 90 per cent of the heat ordinarily lost through the glass, it is said.—Owens-Corning Fiberglas Corp., Nicholas Bldg., Toledo, Ohio.

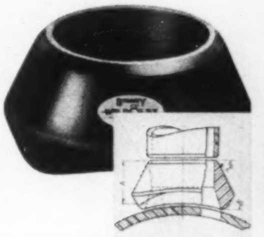
Vertically Mounted Rotary Pump

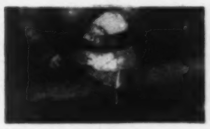
No. 2267—A new vertically mounted rotary pump incorporates the "bucket design" (swinging vane) principle. The unit now in production has a capacity of 150 gpm at a pressure of 100 psi and is powered by a 15 hp

WELDOLETS·
TRADE MARKS · REG. U. S. PAT. OFF.
THREDOLETS
. . . *Welded Outlets for Piping* . . .

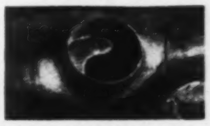
How to Save Time, Materials and Labor in Making Right-Angle Branch Pipe Outlets

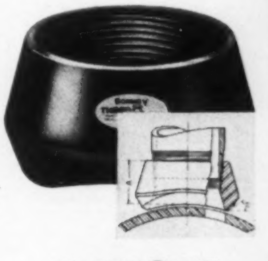
Because Bonney WeldOlets, ThredOlets and Socket End WeldOlets eliminate all cutting and threadin of the main pipe, they will save time, material an labor in making right-angle branch pipe outlets. Thei installation is extremely simple and easy as shown i the illustrations.

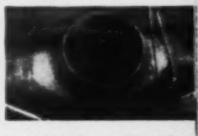

WELDOLET


1—Select the position of the outlet. Ru the fitting over the pipe several times t remove scale, dirt—mark center lines—tack into position.

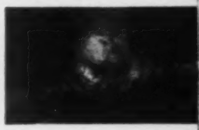
2—Tacking is done in enough places to insure its desired position. No clamps are necessary. Then weld, following and filling the bevel along the base of the fitting. A junction of full pipe strength is assured.

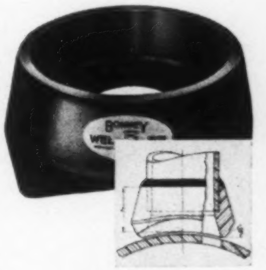

3—When the outlet of the fitting exceed 2", weld the fitting to the main pip and then remove the button—in tw sections. Where the outlet is smalle than 2" or under unusual conditions o larger sizes, the fitting should be used a a templet and the hole cut in the main pipe first.


THREDOLET


4—After the fitting is installed on the main pipe and the button removed, the inside of the joint is in full view for inspection. Interior inspection is impossible with welded pipe-to-pipe intersections, welding tees, saddles, etc. Icicles, scale and excess welding metal are eliminated when WeldOlets, ThredOlet or Socket-End WeldOlets are used. They are removed with the butto

5—The end of the branch pipe is the beveled at 45° and welded to the outle of the WeldOlet. If ThredOlets are used the threaded branch pipe is screwed int the outlet of the fitting—or, if Socket End WeldOlets are used, the branch pip is slipped into the fitting and an ordinary weld made around the top of i


6—The job is then complete. Note the trim, mechanical appearance. External as well as interior obstructions are eliminated, saving materials and reducing the weight of the entire system.


Socket-End
WELDOLET

WeldOlets, ThredOlets and Socket-End WeldOlet form clean, unobstructed branch connections. Thei funnel-shaped intake aperture reduces turbulence and friction. No templets are required, nor is it necessary to do complicated cutting and fitting.

Standard stock fittings are of drop forged steel (outlet from ¼" to 12") in size-to-size and reducing sizes For special applications, or where unusual condition exist, they can be supplied in Toncan Iron, wrough iron, brass, Monel, Everdur, etc. and in sizes up t 24" x 24".

They are suitable for every type of piping installation and for all commonly used pressures and temperatures.

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for air-conditioning ducts when they're lined with

J-M AIRACOUSTIC SHEETS

AGAINST NOISE . . . You'll be guarding against complaints about noise in your air-conditioning installations if you line ducts with J-M Airacoustic Sheets. This modern material soaks up 70% of all noise that strikes it. And its cost is so low that you can include duct quieting in every estimate.

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YOU CAN USE J-M Airacoustic Sheets for lining any type of duct. They are light and easy to handle . . . simple and economical to apply. On the job, their unusual moisture resistance offers protection against humidity . . . keeps maintenance at a minimum. For details, write for brochure AC-23A. Address Johns-Manville, 22 East 40th Street, New York, N. Y.

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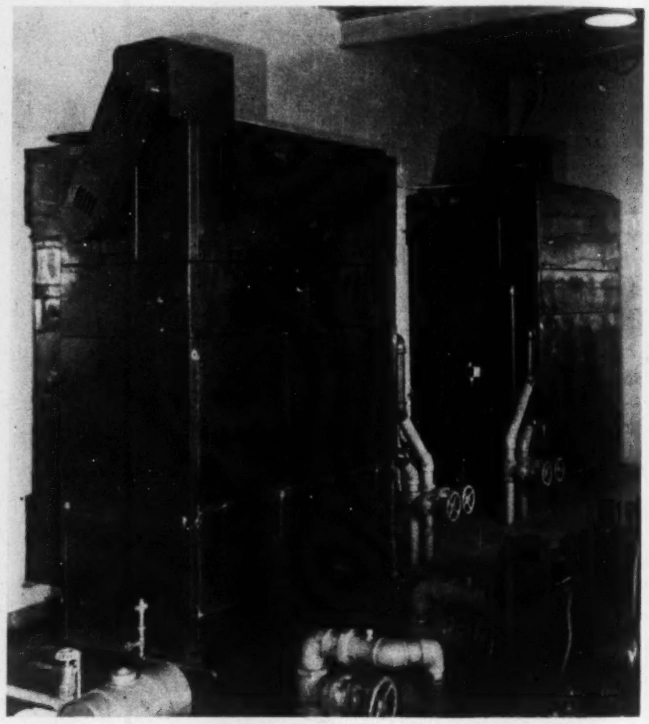
AIRACOUSTIC SHEETS
FOR DUCT LININGS

gearhead motor—300 rpm on the pump shaft. The same type of pump and mounting is also furnished in capacities from 5 to 700 gpm and in pressures up to 300 psi, for marine and a wide range of industrial applications.

The design of this pump enables it to handle a wide range of liquids, varying in viscosities from tar to naphtha, the maker states. An important feature is that when the buckets are completely worn out, the unit may be restored to its original efficiency by removing the head, pulling out the old buckets, replacing them with new buckets and replacing the head.—Blackmer Pump Co., 1809-A Century Ave., S. W., Grand Rapids, Mich.

Evaporative Condensers for Cooling Jacket Water

No. 2268—Industrial plants and other users of stationary diesel engines are finding evaporative condensers to be an economical, space saving solution to the problem of cooling jacket water. Typical of such installations is the one in the power plant of the Tri-County Electric Cooperative, Portland, Mich.



The generative equipment includes two 688 hp diesel engines. The problem was not only to obtain efficient cooling of the jacket water but also to assure its constant temperature under all operating conditions. The condensers, of heavily galvanized steel construction, provide a total cooling capacity of 4,500,000 Btu per hr, and cool the water 20 deg, or from 150 deg entering temperature to 130 deg leaving temperature.

The diesel jacket water is circulated through a coil the external surface of which is wetted with water spray. Fans draw air over the wetted coil and heat is removed by evaporation of the moisture. With the units the heat of vaporization is utilized for economic cooling of the jacket water, effecting a saving in water and power.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

High Pressure Condensate Return

No. 2269—Applications of the "Cochrane-Becker" high pressure condensate return system produce impressive savings in many processing operations where quick heating is necessary, according to its manufacturer.

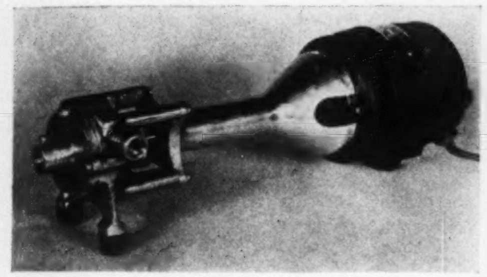
For example, at a plant making gaskets, washers and miscellaneous mechanical rubber goods, 32 vulcanizing presses are in constant operation. Steam is supplied the presses at 120 to 125 psi. The condensate return system evacuates the molding presses at 85 psi.

Previously, the returning condensate flashed in an open hot well was in a large measure wasted, and the heat from the 5 psi exhaust of a compressor engine was completely wasted to atmosphere. Now the condensate is returned direct to the boiler at a temperature approximating 325 F and the compressor exhaust is completely utilized in heating makeup.

The net results of the installation include fewer rejects with increased production and more accurate timing of the cure period plus an estimated 28 per cent fuel saving, the latter due in part to the better heat balance made possible by use of the previously wasted compressor exhaust.—Cochrane Corp., 3161 N. 17th St., Philadelphia, Pa.

Small Hot Liquid Pump

No. 2270—A newly designed and engineered midget hot liquid centrifugal pump is compact in size and construction and is suitable for handling liquids up to 500 F.



It is offered for use in industrial, pilot plant, laboratory and experimental applications.

Its maximum rated capacity is 7½ gpm, and the maximum pressure is 21 psi. It is 12 in. long by 4 in. wide by 4½ in. high, weighs 7 lb, and has a 1/20 hp motor.—Eastern Engineering Co., 45 Fox St., New Haven, Conn.

Refrigerant Dryer and Strainer

No. 2271—The new "A-P Trap-Dri" unit is designed to dry, strain and filter refrigerant in order to stop all impurities such as acid, moisture, gummy deposits, scale, dirt and solder particles that may be in the refrigerating system. The unit combines the "Trap-it" element with silica gel. The former consists of a honeycomb tube equal in efficiency to a 900 mesh strainer, and the silica gel is capable of absorbing 12 to 16 per cent of its weight in water.

TRAP-DRI
STOPS ALL IMPURITIES
TRAP-DRI
Dryer Strainer Filter

These units may be installed ahead of any expansion valve or attached directly to the valve by a special fitting. They are available in several sizes and capacities.—Automatic Products Co., 2460 N. 32nd St., Milwaukee, Wis.

1-A·R·A SHEETS

National Defense regulations restrict the use of metal for duct work. A.R.A. Sheets are designed and made to replace much of the metal in duct work. A.R.A. Sheets are an Asbestos-Clad Board from which ducts may be fabricated. They are tough (200 lbs. per sq. in. Mullen tested), smooth, water-proofed and high insulating (K .45) and sound absorbing efficiency. Standard Sheet sizes 33" x 48" and 16½" x 48".

2-DUCT JOINTS

This asbestos flexible duct connection is an Asbestos Woven Fabric for making a flexible tight, fire-safe, permanent joint between metal duct sections to absorb vibrations and sound travel. Comes in a roll 6" wide, 50 feet long with selvaged edges. Can be screwed, clamped or bolted into place.

Asbestos Protected

3-DUX-SULATION

A flexible insulating blanket ½" thick having a K factor .27 B.t.u. Comes complete with corner tape and adhesive for cementing on to sheet metal duct work. Dux-Sulation comes 36" wide in a roll containing 100 square feet. Easy to apply and a very efficient insulation against temperature losses, condensation and noise travel. Will not rot, chip or crack.

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Sprayo-Flake THE IDEAL INSULATION FOR INDUSTRIAL AND COMMERCIAL BUILDINGS, AIR CONDITIONING AND VENTILATING DUCTS, STORAGE TANKS, DRYERS, FILTERS AND COLD STORAGE ROOMS.

STEEL PLATE DOME BUILDING FOR CHICAGO BRIDGE AND IRON COMPANY—CHICAGO. ARCHITECT, WINSTON ELTING.
Walls and Roof are Steel Plate with all interior surfaces lined with Sprayo-Flake for Thermal Insulation, Condensation Control, Noise Reduction and Interior Finish. The main dome is coated with 2" Sprayo-Flake finished in a soft, smooth, decorative white effect. The ceilings of the outer structure are Sprayo-Flake finished with Aluminum Paint. Walls are covered with Sprayo-Flake Plaster Base 1/2" thick finished with smooth Plaster.

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The Sprayo-Flake Process fabricates and applies insulation in one efficient, and economical operation. A specially constructed spray gun forcibly projects dry fibrous material along with an atomized adhesive, the combination results in the building up of a homogeneous, light weight cellular blanket.

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Sprayo-Flake can be applied to any clean surface — wood, masonry, concrete, metal, plaster, asbestos siding, etc., in any desired thickness. Sprayo-Flake insulates, (thermal conductively 0.246 B.t.u. per sq. ft. per inch thickness) absorbs sound, is resilient and does not deteriorate, is moisture-proof and fire-safe, prevents condensation, is self-supporting (needs no mechanical supports or anchors in application), and is "tailor-made" to fit every job, on the job!

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Applied by licensed and approved applicators, Sprayo-Flake gives assurance of complete insulation satisfaction as well as an attractive and permanent finished job.

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Complete new catalogue will be sent upon request!

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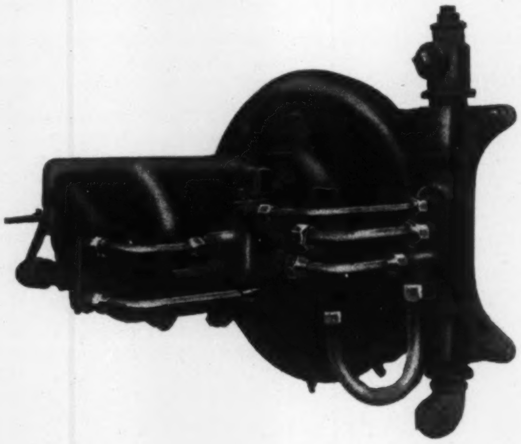
INDUSTRIAL AND COMMERCIAL OIL BURNERS

have been famed as "Oil Misers" for many years. Petro's Thermal Viscosity principle maintains combustion at top efficiency with pre-heated "Bunker" oils, without manual readjusting.



Automatic, semi-automatic or manual operation using No. 5 (or lighter) oil—or No. 6 (Bunker "C") oils, pre-heated. Capacities to 145 gallons per hour. 487 boiler H. P.—68,000 sq. ft. steam.

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Since 80% of Petro's expanded production is on ordnance, and all of the industrial burners we can produce are earmarked for war work, we cannot fill orders without top priorities.

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Acidproof Pipe and Fittings

No. 4154—12 p. bulletin (550) on acidproof pipe and fittings, comprising a comprehensive catalog describing chemical stoneware and giving engineering and technical data, installation information, data on calking, and complete dimensional and weight tables for pipe, fittings and accessory equipment.—U. S. Stoneware Co., 60 E. 42nd St., New York, N. Y.

Air Conditioners

No. 4155—24 p. engineering bulletin (G-2) on capillary air conditioners, describing the capillary cell and its application in air conditioning equipment as a direct heat transfer surface between water and air. Functions of the cell and its humidifying and saturation efficiency are discussed, and there is a great deal of data on evaporative cooling, as well as drawings and pictures showing the adaptation of the cells to air conditioning apparatus. Complete dimensional, capacity, engineering and performance data are included with performance charts, and capillary unit air conditioners are described. It is pointed out that cooling and dehumidification can be accomplished by the application of chilled water directly on the cells without the use of metal coils.—Air & Refrigeration Corp., 475 Fifth Ave., New York, N. Y.

Asphalt Board

No. 4156—Data sheet on asphalt board, giving information on use in conventional and special building applications and listing its properties, including resistance to water, acids, mildew, vapors, termites and moths.—Keystone Asphalt Products Co., 43 E. Ohio St., Chicago, Ill.

Ball Bearings

No. 4157—8 p. bulletin answering the question "How are balls made round?", describing and picturing the various steps in the process of making balls—most of which are used in bearings—of steel, bronze and special metals. —SKF Industries, Inc., Atlas Ball Div., Front St. and Erie Ave., Philadelphia, Pa.

Blowers

No. 4158—20 p. catalog (SD1141) on dynamically balanced standard duty blowers, containing performance ratings, dimensions, discharge and drive arrangements, and describing enclosed drive blower sets, twin and triple blowers and other air moving equipment.—Utility Fan Corp., 4851 S. Alameda St., Los Angeles, Calif.

Blowers and Fans

No. 4159—4 p. bulletin on "Fiftieth Anniversary" belt and direct drive utility blowers and ventilating sets, giving dimensional drawings and tables, information on capacities and list prices. Also, 6 p. folder on "Fiftieth

HE DREW THE PLANS FOR FLEETWINGS' FANS

CHARLES H. KNECHT (*left*), head of the Harry Knecht Co., Merchantville, New Jersey, specified ILG Power Roof Ventilators . . . when his firm of heating and ventilating contractors recently handled a heat-and-fumes-removal problem in a plant turning out Fleetwings, basic training planes for army air bases.

FIRST STAINLESS STEEL PLANES for military use are the BT-12's being built in this modern plant (*below*)... Heat, smoke, welding fumes are removed by six 42-in. ILG Self-Cooled Motor Propeller Fans in the penthouses.

ILG "SELF-COOLED" MOTORS stand continuous operation under direct radiant heat of sun . . . and terrific heat from working zone!... In addition to ILG units pictured above, the plant is served by six 30-in. ILG Propeller Fans on a smaller building . . . and ILG B-18 Blowers supply fresh air to inside test rooms.

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Ask for No. 141

POSITIVE ALL-WEATHER VENTILATION— Powerful ILG Self-Cooled Motor Propeller Fan in weather-tight penthouse assures quick, positive ventilation under all weather conditions. Exclusive self-cooled motor that "breathes"—never over-heats, is not affected by moisture condensation, lowers costs.

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Induced Draft Cooling

Natural Draft Cooling

Rotojet Spray Nozzles

Indoor Installations

Outdoor Installations

BINKS cooling towers are designed to cut down water bills and reduce operating costs of modern air conditioning equipment. Each tower is tailor made for the particular job in hand. The towers are light in weight, adaptable to small areas and quiet in operation. BINKS ROTOJET spray nozzles break the water into an exceptionally fine mist for maximum cooling. Drift moisture is reduced to a negligible factor. In BINKS cooling towers both the first cost and operating costs are low. BINKS cooling towers are made in all sizes and types—forced draft or natural draft—for use indoors or outdoors.

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CONVERTORS
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Hot water heating in large buildings by the forced circulation method has many definite advantages including: the ability to carry the heating water for long horizontal distances, the ease of exact control, and the possibility of carrying relatively heavy overload.

Whitlock Convertors, made to fit the particular condition, have been installed in many large buildings, including: United Benefit Life Insurance Company, illustrated here; Bankers Life Company, Des Moines; Connecticut General Life Insurance Co., Hartford; and the Harvard Medical School, Boston, Mass.

Dependence upon Whitlock Heat Transfer Equipment is a habit of Architects, Engineers, and Contractors all over the country. Illustrated Bulletins available.

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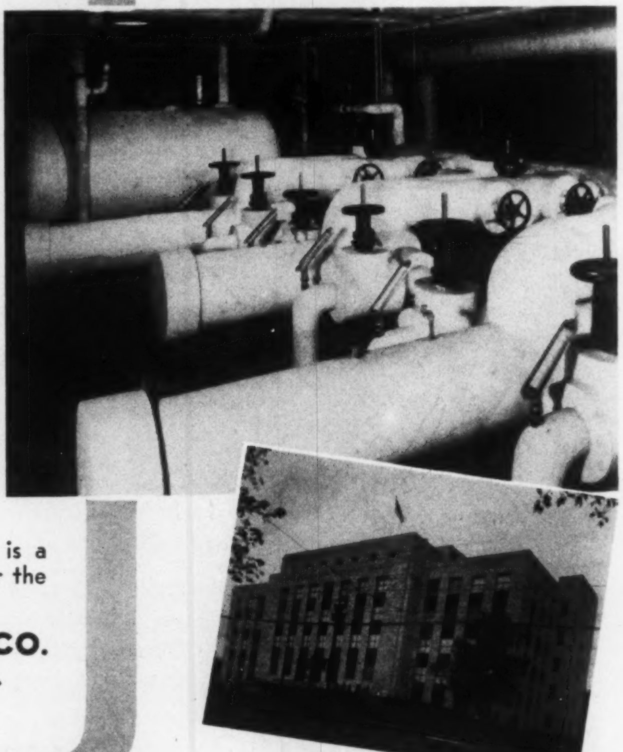


Anniversary" exhaust fans, attic fans and ventilators, with descriptions of features, capacities and prices and dimensional data.—Peerless Electric Co., 3021 W. Market St., Warren, Ohio.

Cement

No. 4160—4 p. leaflet describing "No. 7B Quick Patch" cement, a new product for patching concrete floors quickly.—Smooth-On Mfg. Co., 568-574 Communipaw Ave., Jersey City, N. J.

Centrifugal Pumps

No. 4161—12 p. bulletin (7167) on two stage centrifugal pumps, describing and illustrating their features, giving performance tables, and with a comprehensive tabulation showing friction of water in various sizes of pipe, together with the solution of a typical pumping problem.—Ingersoll-Rand Co., 11 Broadway, New York, N. Y.

Compressors

No. 4162—28 p. bulletin (L-675-B1) on horizontal duplex, feather valve compressors rated at from 75 to 3000 hp, motor driven, direct connected and belted. Features of construction are illustrated and described in detail, and various installations are pictured.—Worthington Pump & Machinery Corp., Harrison, N. J.

Conservation

No. 4163—Series of leaflets on how to make globe valves last longer, how to make safety and relief valves last longer, and how to make thermometers and control instruments last longer, giving brief, practical suggestions and illustrated with thumbnail sketches.—Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Conservation

No. 4164—Poster on conservation of vital materials, printed in red, white and blue, 22 in. by 30 in. in size, and available in reasonable quantities on request.—Jas. P. Marsh Corp., 2073 Southport Ave., Chicago, Ill.

Controls

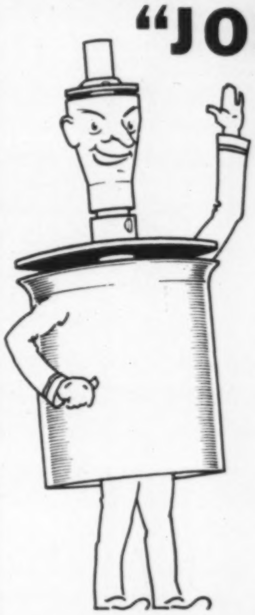
No. 4165—16 p. condensed catalog (1508-G) on automatic controls for heating service, with complete information on the manufacturer's line, illustrations, and data on applications, features, specifications, ordering, shipping weights and prices.—Penn Electric Switch Co., Box 556, Goshen, Ind.

Damper Regulators

No. 4166—8 p. catalog on dampers, damper regulators, remote control regulators and accessories. Also, a reprint describing use of remote control regulators operating dampers with cable lengths up to 140 ft per unit, used in a mattress factory for directing the flow of cotton through blast pipes to the different bins or machines.—Young Regulator Co., 4500 Euclid Ave., Cleveland, Ohio.

Gas Fired Unit Heaters

No. 4167—Large folder showing applications of gas unit heaters to industrial plants engaged in war produc-



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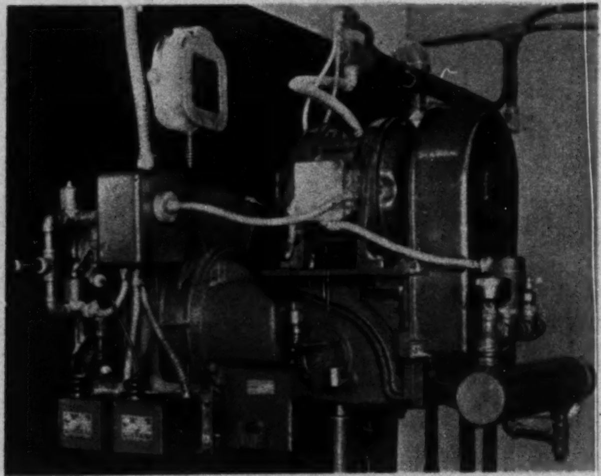

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tion, summarizing the advantages of the equipment and giving a partial list of army and navy installations. A specimen copy of how to write gas fired unit heater specifications, and a complete catalog of units, are also available.—Reznor Mfg. Co., Mercer, Pa.

Heat Transfer Surface

No. 4168—6 p. engineering bulletin giving simplified tables and data on extended surface tubing, together with *U* factor curves and a discussion of heat transfer and resistance of the tubing.—Tilco-Fin, Inc., 58 Second Ave., Brooklyn, N. Y.

Industrial Equipment

No. 4169—11 p. bulletin (WP-1099-B10A) describing how the manufacturer serves industry, giving lists of equipment for buildings and for various industries with illustrations of applications.—Worthington Pump & Machinery Corp., Harrison, N. J.

Instrument Springs

No. 4170—12 p. bulletin on instrument springs, an informative and useful technical discussion including a great deal of data on the subject.—All-Weather Springs, 72 Washington St., New York, N. Y.

Pressure Reducing Orifices

No. 4171—4 p. bulletin (W-318-B19) on multiple pressure reducing orifices for service in boiler feed bypass lines, discussing the purpose and arrangement of the bypass and giving ratings, weights and dimensions.—Worthington Pump & Machinery Corp., Harrison, N. J.

Priorities

No. 4172—Issue of the publication Temperature Times (Vol. 2, No. 1) on priorities and how you can get them, including an interesting chart on the origin of priority business and orders P-55, P-84 and P-19-g.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn.

Refrigeration Storage

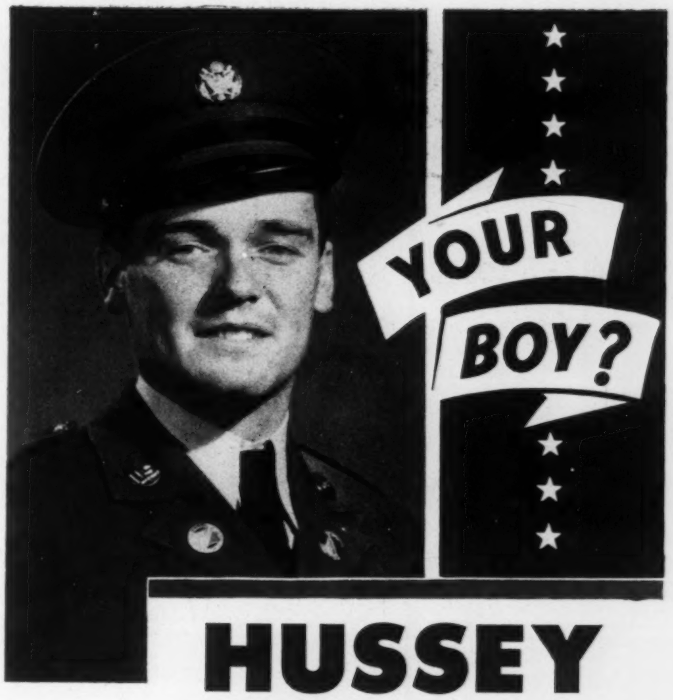
No. 4173—16 p. bulletin (105) on the "Icy-Flo" accumulator, a device for the storing of cooling capacity, giving a description of the unit, performance data, load determination and information on accumulator selection. Economics are discussed and there are numerous tables on degree hours, sun intensity and other technical information.—McQuay, Inc., 1600 Broadway, N.E., Minneapolis, Minn.

Rubber

No. 4174—11 x 17½ in. wall poster on importance of saving rubber, giving condensed, simple rules for conservation.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Rubber Products

No. 4175—Last two of a series of six pamphlets on how to get the most service out of industrial rubber products, covering rubber hose, and mats and matting.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.



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No. 4176—Leaflet describing the "Divizor" for circles, which gives instant readings of diameter and circumferences of any circle up to 72 in. in steps of 1/8 in. or less.—Interstate Sales Co., 1123 Broadway, New York, N. Y.

Steam Generators

No. 4177—6 p. bulletin (1000) on automatic unit steam generators for light or heavy oil, available as standard in all sizes up to and including 500 boiler hp and pressures to 200 psi. Capacity and dimensional data are included.—Preferred Utilities Co., Inc., 33 W. 60th St., New York, N. Y.

Stokers

No. 4178—24 p. bulletin (578) on the "UniStoker," describing and illustrating by means of interesting lettered pictures the numerous features, automatic regulation, and with drawings showing applications to all types of boilers. A number of jobs in plants and buildings on which these stokers are used are illustrated. Also, 12 p. bulletin (578) on the manufacturer's complete line of various types of stokers, describing and illustrating their respective features.—Detroit Stoker Co., General Motors Bldg., Detroit, Mich.

Temperature Indicators

No. 4179—16 p. bulletin (A-305) on potentiometer temperature indicators available in single point and multiple point models, models equipped with selective key switches for as many as 82 contact points, as well as portable models.—Foxboro Co., 106 Neponset Ave., Foxboro, Mass.

Temperature Regulators

No. 4180—16 p. bulletin (600) on temperature regulators for heat control in industry, covering self-operated regulators for water heaters and various industrial process applications. Devices are described and illustrated in detail and there are several charts of valve capacities and a table of valve dimensions.—Sarco Co., Inc., 475 Fifth Ave., New York, N. Y.

Valves

No. 4181—Handy pocket card reproducing a simplified psychrometric chart and illustrating the manufacturer's automatic valves.—Electrimatic Corp., 2100 Indiana Ave., Chicago, Ill.

Valves

No. 4182—Small 6 p. folder illustrating the manufacturer's semi-steel valves and fittings for refrigeration service and listing their features.—Frick Co., Waynesboro, Pa.

Welding Fittings

No. 4183—Large mailing piece featuring an isometric drawing of a paper mill, showing the numerous piping services required and where welding fittings are used in the lines. The advantages of the manufacturer's welding fittings are illustrated and briefly described and the numerous applications are indicated.—Tube-Turns, 238 E. Broadway, Louisville, Ky.

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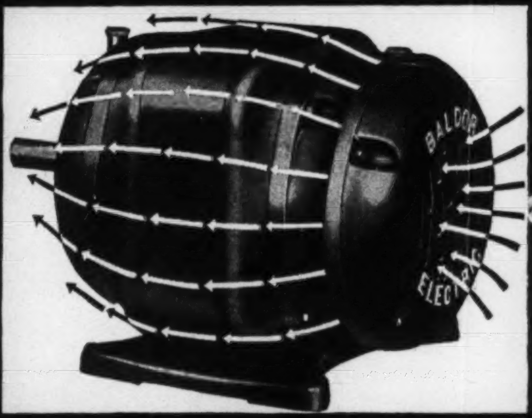

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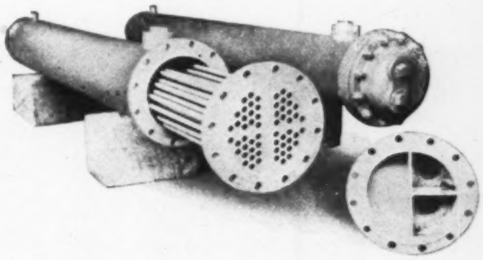

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Useful Information

Revision of ASME Boiler Construction Code

3

Announcement was made by the American Society of Mechanical Engineers early this year of a modified plan for the revision of section VIII of the ASME boiler construction code. The special committee of the boiler code committee to revise section VIII has recently completed a preliminary draft of the proposed revision.

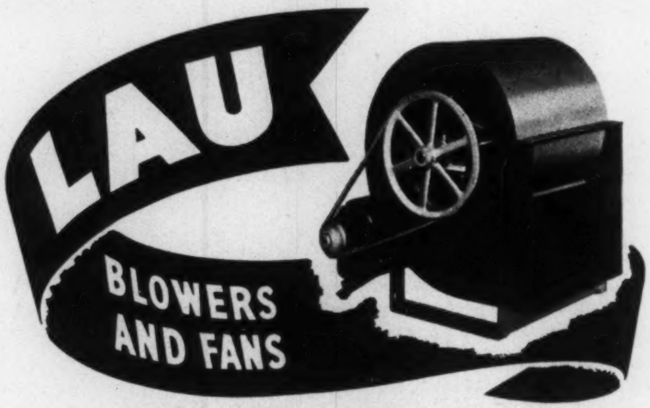
The general arrangement of the draft is quite similar to that followed by the API-ASME code for unfired pressure vessels. The important changes between the present section VIII and the proposed revision can be briefly summarized as follows:

1) The uses to which vessels built under a given set of requirements can be put on account of the difference in the hazard involved, which are now specified in paragraphs U-68, U-69 and U-70, have been eliminated except for vessels containing lethal liquids and gases which are required to be both stress relieved and radiographed.

2) The efficiencies of fusion welded joints are the same as given in the API-ASME code.

3) The rules for determining the shell thicknesses of vessels include an additive thickness for corrosion designated by c in the formulas. The added thickness c may be zero when previous experience has shown that corrosion does not occur. For air, steam and water vessels, c is to be made equal to $t/6$, except it need not exceed $\frac{1}{16}$ in.

4) Provision is made for a minimum factor of safety of four for vessels constructed of steel plate.



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5) Appendix A will contain recommendations which will not be mandatory for periodic inspection, repair and maintenance, and allowable safety valve settings for vessels in service. They are adapted particularly to the oil refining industry.

6) Mandatory rules have been included for trepanning specimens from the main welded joints, where such vessels are not radiographed and have plate thickness in excess of ¼ in. However, local radiographic examination of the welded seam may be substituted.

7) Premiums are allowed for the work performed on the vessel, the greatest premium being for a vessel which is radiographed. Where mandatory stress relieving and/or radiographing is not required either or both of these operations may be performed and the premiums used accordingly.

8) The hydrostatic and proof tests follow closely the requirements of the API-ASME code.

Although the draft has been submitted to the members of the boiler code committee, it has not been discussed by them and is therefore subject to possible change. However, the committee has decided to release this preliminary draft for general distribution and critical review, in order to expedite the work as much as possible. Comments are invited from all interested parties, with the request that they be received by the secretary of the boiler code committee not later than July 1.

Copies of this draft may be obtained from the ASME at 29 W. 39th St., New York, N. Y., at $1.00 per copy.

Standards for Air Conditioning and Refrigeration Equipment

The Air Conditioning and Refrigerating Machinery Association, Southern Building, Washington, D. C., has issued interim equipment standards on "Freon-12" water

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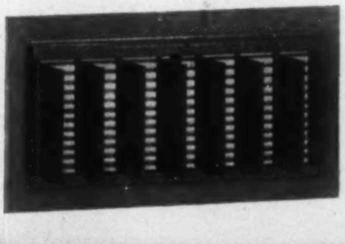

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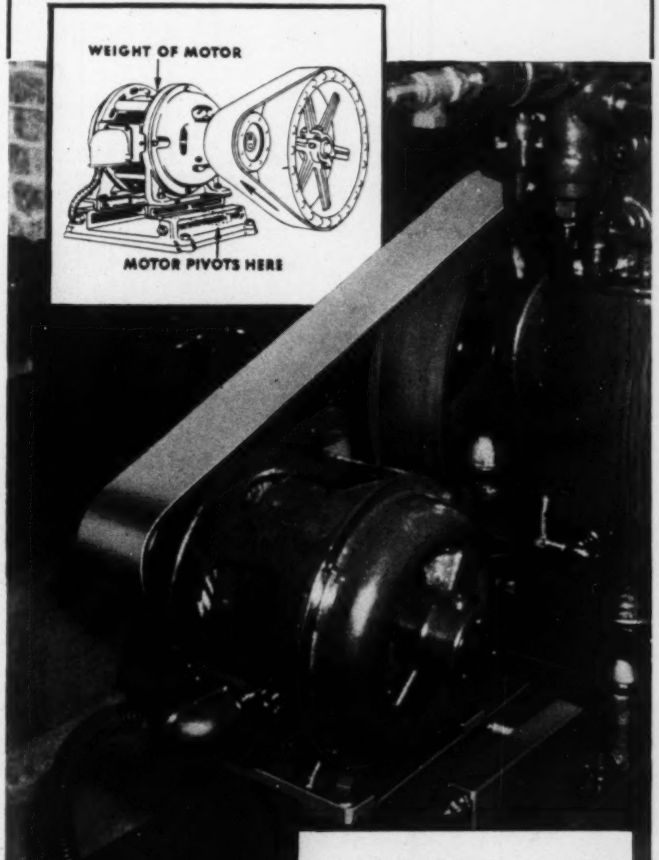

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and brine coolers, and forced circulation air coolers for commercial and industrial refrigeration. These standards supplement previously published ACRMA equipment standards and the designation "interim" is used to indicate that they are of a less detailed nature than those previously published and that the subjects covered are receiving further study. Copies of these interim standards may be obtained from the ACRMA for 30c.

These interim standards are also included in a booklet which contains in addition the ASRE proposed standard methods of rating and testing water and brine coolers, forced circulation air coolers for commercial and industrial refrigeration, water cooled refrigerant condensers and refrigerant compressors. This complete set of six standards may be obtained from the ACRMA for $1.

Collapsing Pressure of Thin Walled Piping

The problem of determining the external pressure at which a thin walled cylinder will collapse confronts the designers of boilers, penstocks, vacuum tanks and similar units. In the design of hydro-electric or water supply projects, problems of determining the collapsing pressure of thin walled pipe and of evaluating the effect of stiffeners upon the strength of the pipe are frequently encountered. Many industries using distillation processes under partial vacuum are confronted with the problem of designing tanks to withstand external pressure. The design of submarines involves the same problem under complicated conditions.

Many experiments have been made to determine the collapsing pressures of small pipes, such as boiler tubes,

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and of heavy walled, lap welded steel pipe, but the conditions encountered in large flumes, submarines and tanks have not been studied until recently. Tests have also been made to determine the buckling strength of thin walled cylinders subjected to axial loads. Theoretical analyses of the behavior of cylinders under external pressures have been made by a number of investigators.

The purposes of the study described in bulletin No. 329, A Study of the Collapsing Pressure of Thin Walled Cylinders, by Rolland G. Sturm, which has just been issued by the Engineering Experiment Station of the University of Illinois, are:

a) To analyze the elastic behavior of thin circular cylindrical shells subjected to uniform external pressure, and to determine the pressure at which such shells collapse for simply supported and for fixed edges; extensions in the analysis are made for plastic behavior of the material, for "out of roundness" of the cylinder, and for stiffening effects of ring stiffeners.

b) To study experimentally the behavior of thin walled tubes under uniform external pressures, for comparison with the results of the theoretical analysis.

Until August 15, 1942, or until the supply available for free distribution is exhausted, copies of bulletin No. 329 may be obtained without charge upon application to the Engineering Experiment Station, Urbana, Ill.

Thermodynamic Properties of Air

At elevated pressures, air deviates significantly from perfect gas behavior and in many instances it is desirable to take these effects into account, although for some engineering purposes it is sufficiently accurate to consider air to be a perfect gas of constant heat capacity.

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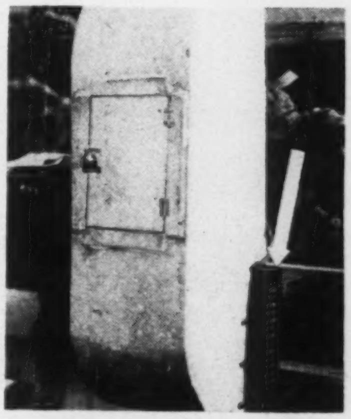

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The thermodynamic properties of air have been computed from existing experimental data at pressures up to 3500 psi in the temperature interval between 32 and 550 F. Tables of the heat capacity and isothermal enthalpy-pressure derivative of air; specific volume, enthalpy, and entropy of air; and a temperature-entropy diagram of air, together with many references on the subject, were published by R. V. Gerhart, F. C. Brunner, H. S. Mickley, B. H. Sage and W. N. Lacey in the April, 1942, issue of the journal of the American Society of Mechanical Engineers, Mechanical Engineering.

ASRE Issues Index

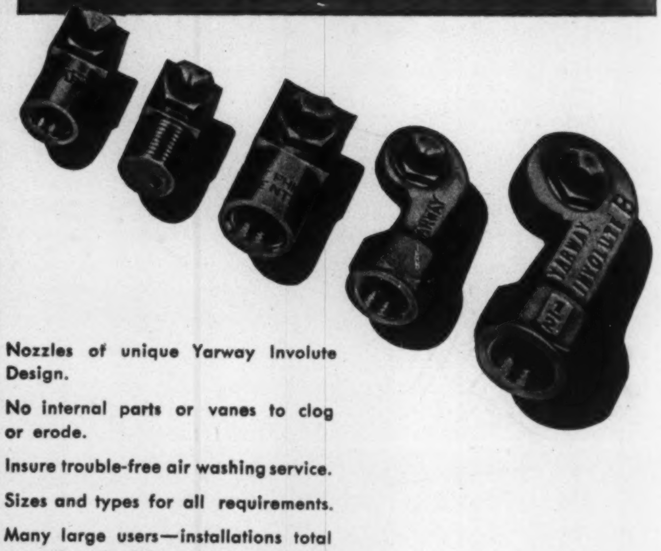
The American Society of Refrigerating Engineers, 37 W. 39th St., New York, N. Y., has issued a 20 p. index to its journal, the publication Refrigerating Engineering. This index covers the period from January, 1935, through December, 1940, as an index for earlier issues from 1904-1934 was printed in December, 1934.

Copies of this index may be obtained on request by ASRE members and at $1 per copy by others.

OPA and WPB Price Schedules

Official texts of over 600 OPA and WPB price schedules, limitation orders, allocation rulings, preference ratings, amendments and interpretations have just been made available by the New York Journal of Commerce for distribution among the nation's merchants and manufacturers. A price and priority index of all existing government regulations covering a wide product range from acetone to zinc has been compiled for handy reference purposes.

AIR CONDITIONING
NOZZLES



Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-616.

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YARWAY

OPA price schedules were inaugurated in the machine tool industry over a year ago and are now in effect on well over a hundred products. M orders regulating the flow of materials came along shortly afterward and remain in effect despite the abolishing of the OPM. Limitation orders restricting the output of manufactured goods were first applied on motor trucks in August of last year. Adjustment to a wartime economy hit a peak in mid-February when as many as 18 different orders were issued by the various government agencies on a single business day.

Individual texts as published in the columns of the Journal of Commerce are available in single copies or bulk quantities. Copies of the complete index may be had without charge by addressing the New York Journal of Commerce, 63 Park Row, New York, N. Y.

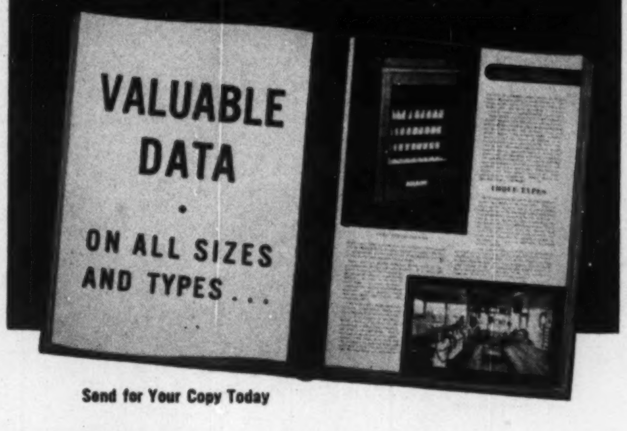
Thermodynamic Properties of Water and Water Vapor

2

Paul J. Kiefer, USN Postgraduate School, Annapolis, Md., has prepared a tabulation of some of the properties of water in the solid, liquid and vapor states over a temperature range of from minus 40 degrees Centigrade to plus 50 degrees. The tabulation was prepared for the use of meteorologists from the data published in Thermodynamic Properties of Steam, by J. H. Keenan and F. G. Keyes. Units of temperature, pressure and energy were converted from those conventionally employed by engineers to the ones preferred by meteorologists.

Mr. Kiefer's tabulation and an accompanying discus-

REZNOR GAS UNIT HEATERS AID ALL-OUT FACTORIES . . .



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This interesting Reznor catalog illustrates a wide variety of unit heater installations. A master form for writing specifications is enclosed. In addition, the catalog provides worth-while mechanical data for fan, blower, and duct types which are manufactured by Reznor in a complete range of sizes. Reznor units are rapidly installed, and provide 89% savings in vital materials compared to cast radiation systems. . . . Write for catalog U 42 today.

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- **Adjustable Directional Grilles**
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This is an exceedingly important point right now. In addition Therm-O-Tile is the simplest, strongest and most efficient underground conduit.

Monolithic concrete base. No broken stone fill. No bell joints. Condensate pockets cannot form. Strong arched construction. Internal channel drain. Etc. Ask for Bulletin 381.

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Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective job, on which we shall be glad to have your ☐ comments, ☐ quotations.

Name ....
Firm ....
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City ....State....................

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Keeps Circulating Lines OPEN!

Remove scale, rust, dirt, slime and algae from all air conditioning and refrigeration systems with SOL-VET "08." SOL-VET "08" dissolves all impurities in water cooled condensers, circulating lines, and all equipment using water for cooling, and carries them out in solution preventing clogging. SOL-VET "08" acts quickly yet harmlessly. Only 6 to 8 hours of forced circulation will clean the most heavily scaled equipment . . . even pure zinc is 99% immune to its cleaning action.

SOL-VET "08" keeps water-cooled equipment at its highest peak of efficiency . . . eliminates costly shutdowns and excessive operating costs. Safeguard circulating lines. "Keep 'em Flowing" . . . clean them with SOL-VET "08."

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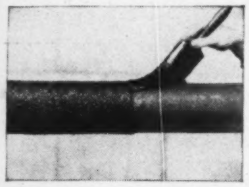
No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts.

The sensational new plastic cork coating that prevents condensation drip from metal, concrete, brick, wood, composition, plaster.

Easy to apply with brush, trowel or spray to plain or corrugated surfaces, corners or at an angle. Stucco-like finish. Can be painted any color.

A gallon covers about 30 feet of 1" O. D. pipe. Comes in 1 gallon cans and 5- and 55-gallon drums.

Order from your supply house or write for Free Circular giving complete information.



NoDrip — Insulates and adds years of life to pipes and other metal surfaces by preventing rust and corrosion.

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sion of it are published in the Monthly Weather Review, Vol. 69, No. 11, dated November, 1941. Single copies of this review are available from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 20c.

Computing Heat Requirements for Buildings in Great Britain

A booklet on the computation of heat requirements for buildings has been issued by the Institution of Heating & Ventilating Engineers, 21 Tothill St., London, S.W.1. Its price—it must be ordered from the IHVE—is 2s. 0d.

A section extracted from the IHVE's guide to current practice, which was issued last year to the institute's members, this 41 p. pamphlet includes tables of temperature rise and rates of air change for buildings ranging from "aircraft sheds" to warehouses; overall heat transmittance coefficients for walls, floors and roofs (with allowances for height); and thermal conductivities of building and insulating materials.

The data are intended to apply to the whole of Great Britain, and it is assumed that the outdoor temperature is 30 to 32 F for design purposes. American engineers of course use the data of the ASHVE, but this booklet is of interest for comparative purposes.

BUY WAR SAVINGS STAMPS AND BONDS FOR VICTORY

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SUITABLE FOR ALL SERVICES; HANDLE LIQUIDS, GASES, VAPORS and REFRIGERANTS

These two-wire, current failure, pilot-operated valves are capable of handling large capacities with a minimum of pressure drop. The main valve is held open electrically, eliminating undue pressure loss. Manual opening device incorporated in design. Available for any voltage, A.C. or D.C. Packless design, coils separable. Available 3/8" to 2" I.P.S.

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TYPE K-15—Pilot piston operated for low and high pressure duty on air, gas, water, light oil and all refrigerants.

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Coming Events

Contractors

Heating, Piping and Air Conditioning Contractors National Association: 53rd annual convention, May 25-27, Hotel Schroeder, Milwaukee, Wis. Reports are to be given on operation of the contractor's shop today under the regulations imposed by the War Production Board, how to sell repair modernization, how to get materials, relations with the government, certification of welders, standards, air conditioning, apprenticeship, etc. George J. Stoehr is chairman of the local convention committee. Headquarters office of the HPACCNA, is at 1250 Sixth Ave., New York, N. Y.

Smoke Prevention

Smoke Prevention Association: Annual meeting, June 2-5, Hotel Statler, Cleveland, Ohio, on how conservation of fuel and elimination of waste can help in winning the war. Subjects to be discussed include smoke abatement in wartime, chimney draft, the Owens automatic dust recorder, coordination of smoke department activities with government efforts to aid war industry, dust fall studies in Cleveland, recovery of metal oxides and other solids from smelting furnaces, and the smoke abatement problem from the locomotive enginemen's and firemen's viewpoints. Headquarters office of the SPA is at 139 N. Clark St., Chicago, Ill.

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METALLIC BELLOWS

● We manufacture bellows and bellows assemblies ready for installation in steam traps, relief valves, temperature regulators, pressure regulators, air valves, and other automatic temperature and pressure controls. Complete engineering service.

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No wonder master plumbers have O.K.'d Rutland Pipe Joint Cement for 30 years. It seals joints tightly—last indefinitely—yet always leaves pipes easy to disjoin. Legal for use in all cities because no toxic ingredients. Remains soft in can. Does not stain hands or fixtures.

Mail post card for free sample. Rutland Fire Clay Co., Dept. (H-5) Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patcher.

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RUTLAND FIRE CLAY CO.
RUTLAND, VT.

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WHAT "CALORIDE" IS—"Caloride" is an especially designed, patented form of moisture absorbing chemical produced in the shape of hard, fused solid blocks as shown above.

WHAT IT DOES—Upon exposure to air, "Caloride" cubes attract moisture, gradually diminishing in size as moisture is absorbed. Due to their patented features, "Caloride" cubes retain their form until they are entirely dissolved—thus permitting free and continuous circulation of moisture laden air or gas through a suitable container filled with cubes.

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Refrigerating Engineers

American Society of Refrigerating Engineers: Spring meeting, June 7-9, Skytop Club, Skytop, Pa. Discussion of expansion of air conditioning of blast furnaces is among the subjects planned for the program. Headquarters office of the ASRE is at 50 W. 40th St., New York, N. Y.

District Heating

National District Heating Association: Annual meeting, June 11-12, Dayton Biltmore Hotel, Dayton, Ohio. Headquarters office, 827 N. Euclid Ave., Pittsburgh, Pa. John F. Collins, Jr., is the secretary.

Heating and Ventilating

American Society of Heating and Ventilating Engineers: Summer meeting, June 15-17, Hotel St. Paul, St. Paul, Minn. For further information, see ASHVE Journal Section. Secretary of the ASHVE is A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Testing Materials

American Society for Testing Materials: 45th annual meeting, June 22-26, Atlantic City, N. J. Headquarters office of ASTM is at 260 S. Broad St., Philadelphia, Pa.

Industrial Advertisers

National Industrial Advertisers Association: 20th annual conference to be held at Atlantic City, N. J., in September. Fred H. Pinkerton, United States Rubber Co., is general chairman of the conference.

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Blower Wheel Housings
of Standard Dimensions

Made in sizes to fit 4½, 5, 6, 7½ and 9 inch wheels and in widths to suit single or double inlet wheels . . . also individual parts for your own assembly.

De-Sta-Co housings are engineered for maximum efficiency and quietness in operation . . . neatly finished. Send for "De-Sta-Co Blower Housings" bulletin; gives complete information, including essential dimensions.

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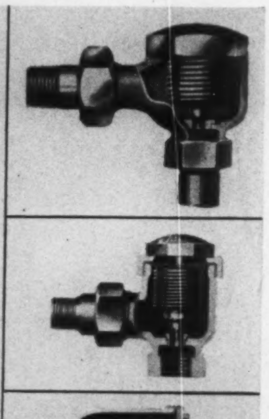
How these Sarco products
MADE ONE BOILER DO THE WORK OF 2

In Racine, Wisconsin, an industrial plant and an office building across the street were heated by two 150 h.p. boilers.

The office system was changed to hot water with a small stoker-fired boiler and Sarco Electric Temperature Controls.

Sarco Steam Traps were placed on all unit heaters, heating coils and drip points. These increased the efficiency enough to allow one boiler to handle the factory load comfortably. Catalog Nos. 250 and 38.



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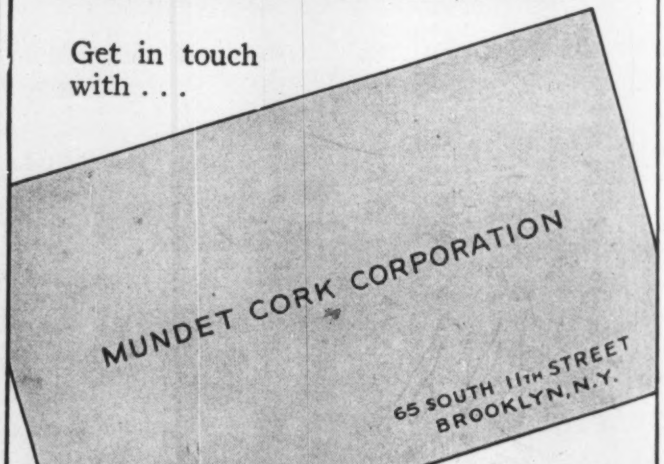

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CORK INSULATION
CONSERVES LOW TEMPERATURE

THE EDITOR'S PAGES

A Message to All Coal Consumers — From Donald M. Nelson

As chairman of the War Production Board, I am urging all consumers of coal, especially large industrial users and war plants, to begin stockpiling coal at once and to increase inventories of this fuel to the limit of storage capacity.

Transportation difficulties will increase in future months, but the railroads and other transportation facilities still have some surplus carrying capacity which must be utilized now in order to avoid serious transportation dislocations next fall and winter.

Moreover, the fuel oil situation on the East Coast and winter weather transportation problems make stockpiling operations now of great importance to all consumers who are now dependent or who may later on become dependent on coal for heating their homes or running their plants and factories.

In addition to transportation problems, it is obvious that we shall consume much more coal than we do ordinarily. All these factors add up to the fact that we can meet all demands and keep our operations running smoothly only if we plan the mining and transportation of coal during the year so that steady maximum use is made of our production and transportation facilities.

If this is not done, there will undoubtedly be serious transportation problems, probably involving emergency rationing.

So far as dealers are concerned in the retail field, if they require financial help in building up coal stocks, and if they purchase coal for shipment from the mines before August 1, 1942, they may apply for loans direct to the Reconstruction Finance Corp. or through their local banks.

Complete cooperation with this program will help the nation avert serious problems. We must stockpile coal to the limit. I know I can depend on your help.

L-38 BANS AIR CONDITIONING EXCEPT FOR ESSENTIAL USES

The War Production Board banned May 15 new installations of air conditioning and commercial refrigeration equipment *except to meet war and essential civilian requirements.* New installations designed solely for personal comfort, such as in theaters, restaurants, hotels, etc., will not be permitted.

Limitation order L-38 also places rigid restrictions on the production, sale, and installation of air conditioning and commercial refrigeration equipment in order to save substantial amounts of iron, steel, copper and other war materials.

Order L-38 prohibits the installation, effective immediately, of any new equipment except on "preferred orders." These orders apply only to the Army, Navy and Maritime Commission, certain other government agencies, Lend-Lease requirements, and persons possessing a preference rating of A-9 or higher issued directly to them and designating the type of equipment desired.

Until June 30, producers are prohibited from manufacturing any items of equipment in excess of the number of such items delivered on preferred orders from April 1 to May 15, or in excess of the number of such items for which unfilled preferred orders were on hand May 15. Producers may use the greater of the two quantities in determining their permissible production.

During any calendar quarter beginning with the quarter July 1—September 30, producers may not manufacture more items of equipment than the number for which they have preferred orders on hand, or the number delivered on preferred orders during the next preceding quarter, whichever is greater.

The order places no restrictions on sales, leases or deliveries of new equipment by a dealer to another dealer or to a producer, or by a producer to another producer or to a dealer, but both producers and dealers are prohibited from selling, leasing or delivering to any other person or from installing any new equipment except to fill a preferred order.

For a period of 90 days from May 15, self-contained room coolers and window type conditioners of less than 2 hp or 2 tons may be produced only for the Army, Navy, or Maritime Commission. Thereafter, such equipment may not be produced for any purpose.

J. M. Fernald, chief of WPB's air conditioning and commercial refrigeration branch, pointed out that while the order results in a ban on new installations of non-essential equipment, it will not interfere with production or installations to cover health requirements, such as food processing and storage.

In considering applications for preference ratings under the order's terms, Mr. Fernald said, the branch will consider the following uses of equipment as "essential":

1) Processing, transportation, storage, preservation, and distribution of food and food products only in those expanding defense communities where adequate minimum facilities do not exist in the opinion of the War Production Board.

2) Production, processing, transportation, storage, preservation, and distribution of milk and dairy products. (This does not include equipment for the manufacture, sale, or distribution of ice cream, frozen confections, carbonated or malt beverages.)

3) Mining, manufacturing processes, communication equipment, and processing methods (including water and liquid cooling) where control of temperature or humidity can be proved necessary for production of the product or products.

4) Ice manufacture and storage only where, in the opinion of the War Production Board, adequate facilities do not now exist.

5) Miscellaneous applications in connection with testing and research laboratories; defense production drafting rooms which can demonstrate proof of actual need; operating rooms in regularly constituted hospital buildings; preservation of drugs, medicine and serums, mortuaries (body storage); production inspection test rooms.

THE EDITOR'S PAGES

Continued

L-79 RESTRICTIONS RELAXED BY WPB

The WPB relaxed on May 23 restrictions imposed on the sale of heating and plumbing equipment in order L-79. The revised order permits shipment until June 30 of equipment for bona fide contractual orders which had been received no later than April 16. Another exemption permits delivery of equipment until July 31 for completion of projects started after July 31, 1941 and through April 9, if the purchaser certifies the necessity of such equipment.

APPLICATION FORM FOR PRODUCTION REQUIREMENTS PLAN SIMPLIFIED

A revised form of application for priority assistance under the production requirements plan, to be used for the third quarter of 1942, was announced last month by J. S. Knowlson, director of industry operations of the War Production Board. New instructions to applicants for preference ratings under the production requirements plan will allow them to omit a considerable part of the information which has previously been required. Users of materials will also be able to supply the same reports on PRP applications which they are now preparing in answer to the general metals questionnaire, form PD-275, and duplication of paper work will thus be avoided.

VISCOSITY COMPENSATION FOR OIL BURNERS

In the article by Kalman Steiner on viscosity compensation for oil burners, published in the May, 1942, HPAC, a commercially available compensator was illustrated in Fig. 2 and its operation was briefly described in the text. To correct any misimplication, it should be mentioned that the device illustrated is a patented product of the Ray Oil Burner Co., San Francisco, and that the use of the word "viscosity" in connection with liquid control devices is reserved to this company by a patent.

BUY SAVINGS BONDS FOR VICTORY!

"The most effective, single method for promoting the systematic purchase of United States savings bonds is through the payroll savings plan. . . . *Time is short.* The ever-increasing demands of our war machine create an urgency that we cannot escape or evade. To raise the billions which we now need to win the war, and to do all in our power to check inflation, we must raise our sights. I am suggesting, therefore, as a total or quota for those administering the payroll savings plan, that *at least* 10 per cent of gross payroll be set aside by employees for the purchase of United States savings bonds. . . . . Working together, management and labor can not only insure the success of this most important war effort, but can lay the foundations for improved industrial relations which will bear increasingly rich fruit in the years to come."

— SECRETARY OF THE TREASURY MORGENTHAU.

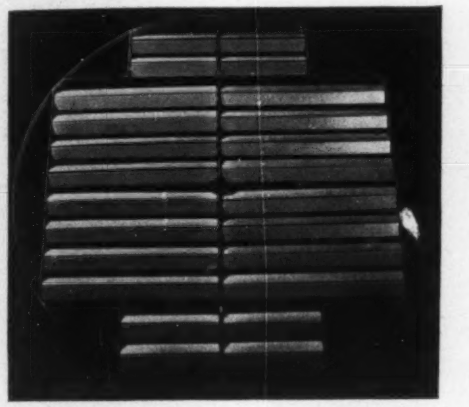
SUMMARY OF PRINCIPAL WPB ORDERS AFFECTING HEATING AND PLUMBING

Heating and Plumbing Product Limitation Orders	
Coal Stokers	L-75
Domestic Cooking Appliances and Heating Stoves	L-23-b & c
Furnaces	L-22
Metal Household Furniture (Includes Radiator Covers and Undersink Cabinets)	L-62
Oil Burners	L-74
Simplification of Heating and Plumbing Products	L-42
Distribution Orders	
Heating and Plumbing Distribution	L-79
Suppliers' Inventories	L-63
Construction Orders	
Defense Projects	P-19
Defense Housing Projects	P-55
Limitation on Construction	L-41
Remodeling for Defense Housing	P-110
Repair and Maintenance Orders	
Farm Machinery and Equipment	P-95
Industrial, Institutional, Governmental	P-100
Heating and Plumbing	P-84
Utilities	P-46
Raw Material Conservation Orders	
Aluminum	M-1
Asbestos	M-79
Cadmium	M-65-a
Chromium	M-18-a
Cobalt	M-39-b
Copper	M-9-a, b & c
Cork	M-8-a
Cotton Duck	M-91
Iron and Steel	
Alloy Iron and Steel	M-21-a
Chrome Steel	M-21-d
Iron and Steel, general	M-126
Iron and Steel Scrap	M-24 & M-24-a
Pig Iron	M-17
Steel	M-21
Steel Plates	M-21-c
Warehouses	M-21-b
Jute	M-70
Lead	M-38
Nickel	M-6-a, b & c
Rubber	M-15-b
Synthetic Resins	M-25
Tin	M-43-a
Vanadium	M-23-a
Zinc	M-11 & M-11-a
Fuel Conservation Orders	
Coal and Coke	M-97
Fuel Oil	L-56
Liquefied Petroleum Gas	L-86
Natural Gas	L-31
Miscellaneous	
Farm Machinery and Equipment Limitation Order	L-26
Manufacturer's Report on Metal Requirements	PD-275

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1942, Heating, Piping & Air Conditioning *and thus keep your records of sources of supply up to date throughout the year...Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed*

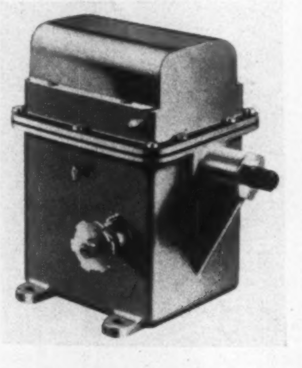
Equalizing Air Flow



No. 2272—An equalizing damper has been placed on the market and is offered "for unlimited adjustments in equalizing one sided air flow, controlling the direction of flow, and controlling the volume up to 60 per cent of the supply air." The damper is a simple device of galvanized steel which fits at the top of the supply duct leading to the outlet. It is made in three sizes — small, medium and large.

It comprises a series of scientifically designed blades, each independent of the other. It can be set for any condition, the adjustment being changed as often as desired and as conditions make it necessary. Primarily designed for use on the manufacturer's system of air diffusion, it is stated to be equally efficient on many of the other types of diffusion installations.—Anemostat Corp. of America, 10 E. 39th St., New York, N. Y.

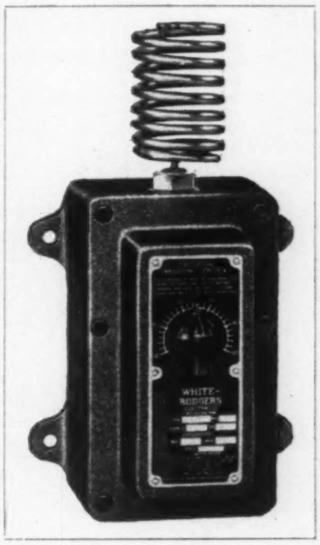
Proportioning Control Motor



No. 2273—The new "Microtrol" is offered for operating butterfly valves, multiple ratio fuel valves and regulating dampers in air conditioning and drying systems.

It comprises a high torque proportioning control motor, with built in limit switches and a potential dividing rheostat. The output shaft is driven by a shaded pole induction motor through a gear reduction. The oil submerged units have the operating mechanism completely submerged in oil and sealed in a die cast case—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Explosionproof Thermostats



No. 2274—A new line of explosion proof thermostats has been approved by the Underwriters' Laboratories, according to the manufacturer, and is available for heating, refrigerating and air conditioning installations where hazardous conditions exist. They are especially recommended for use in oil refineries, munitions plants, cleaning plants and similar locations.

There is a self-contained type for controlling the temperatures of large air spaces and a remote bulb type for controlling temperatures in ducts, walk-in coolers, liquid baths and similar applications. An external knob or a tamperproof internal adjustment is available on both fixed and variable differential types.

Temperature ranges are from 40 to 90 F and temperature differentials on the fixed type are 3 deg, and on the adjustable type from 3 to 22 deg.—White-Rodgers Electric Co., 1209 Cass Ave., St. Louis, Mo.

Plastic Tubing

No. 2275—A new line of plastics which have a wide range of uses as alternative materials was recently announced. According to the manufacturer, while priority certificates are not absolutely necessary, in some cases, ratings of A-10 or better should accompany orders.

The Type "I" tubing is applicable as a replacement or

[6-42]

For Your Convenience

Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature." (*Circle each number in which you are interested*):

2272 2273 2274 2275 2276 2277 2278 2279 2280 2281
2282 2283 2284 2285 2286 2287 4184 4185 4186 4187
4188 4189 4190 4191 4192 4193 4194 4195 4196 4197
4198 4199 4200 4201 4202 4203 4204

Name.............................. Title...............

Company ....

Address ....

City.............................. State...............

America's Secret Weapon

You won't find it on the production lines at Rock Island or Willow Run.

It isn't guarded at the Brooklyn Navy Yard, or tested at Aberdeen.

But it's the toughest weapon these men you are looking at will ever take into battle. It's the stuff with which all our wars are won.

The boy in the uniform doesn't call it *morale*. That's a cold potatoes word for something John American feels deep and warm inside.

Perhaps he can't give it a name. But he can tell you what it's made of.

It's made of the thrill he gets when his troop train stops at a junction point and fifty good-looking girls are at the station with cigarettes.

It's made of the appreciation he feels for a bright new USO clubhouse where he and his friends can go for a few hours' rest and relaxation.

It's made of laughter and music—when Bob Hope or Lana Turner visits his camp with a USO show.

It's made of his invitations to the homes of pleasant strangers.

It's made of a cup of coffee and a Yankee smile—at some lone outpost in Alaska or in the Caribbean.

Maybe it's just a feeling of kinship with this land of a hundred million generous people. Maybe it's just the understanding that this whole country cares; that the soldier is bone of our bone; that he and we are one.

Name it if you can. But it's the secret weapon of a democratic army—a weapon that can never be *ersatzed* in Germany or Japan.

What can you do to sharpen this weapon? Give to the USO. This great national service organization that overrides race and creed has been entrusted by your government with responsibility for the service man's leisure needs. With maintaining clubhouses and providing camp shows, with a hundred thoughtful services to our men at home and abroad.

The needs of USO have grown as enormously as our armed forces themselves. This Spring we must have $32,000,000.

Give all you can—whether it's a lot or a little.

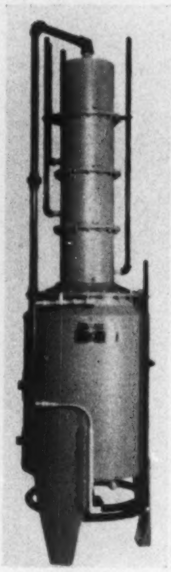
Send your contribution to your local chairman or to USO, Empire State Building, New York City.

★ **USO** ★

as an expedient for copper or other metallic tubing where the temperature does not exceed 200 F. It is unaffected by water, acids or alkalies at room temperature, does not support combustion and is made up to the ¾ in. OD size, says the maker. Plastic fittings of the flare type are available up to ⅜ in. OD, though any flare fitting or pressure fitting of brass can be used.

The Type "II" tubing is made rubberlike in flexibility, or rigid similar to Type "I." It can be had up to the 1½ in. ID size. In the rigid style it requires an A-10 priority, but in the flexible type an A-1-c or better rating is required. This tubing can be joined to tubing of metal with either plastic fittings or with existing fittings of metal.—Colonial Alloys Co., E. Somerset, Trenton Ave., and Reading R.R., Philadelphia, Pa.

Cold Room Air Conditioners



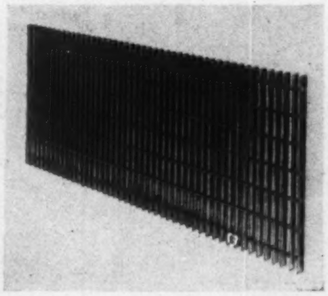
No. 2276—Cold room air conditioners providing constant temperatures as low as —50 F to —80 F are available for manufacturers required to test or normalize parts, materials and machinery at such temperatures, and for experimental laboratories. The "No-Frost" method provides equipment for maintaining these low temperatures, and also for introducing make up air to the rooms.

This new equipment, using "No Frost" liquid (no brine), gives constant operation without interruption or loss of capacity by reason of ice or frost forming on cooler coils or because of corrosion of the equipment from contact with brine or calcium, says the manufacturer. It consists of coolers operated in stages, the first stage reducing to temperature just above the freezing point of water and removing humidity; the second stage removes the balance of the moisture, and the third stage produces and holds the required final temperature.

Moisture is removed from the air below 32 F without causing formation of ice on coolers by a method which employs a special nonfreezing liquid continuously reconcentrated in a concentrator (illustrated) designed especially for this duty. —Niagara Blower Co., 6 E. 45th St., New York, N. Y.

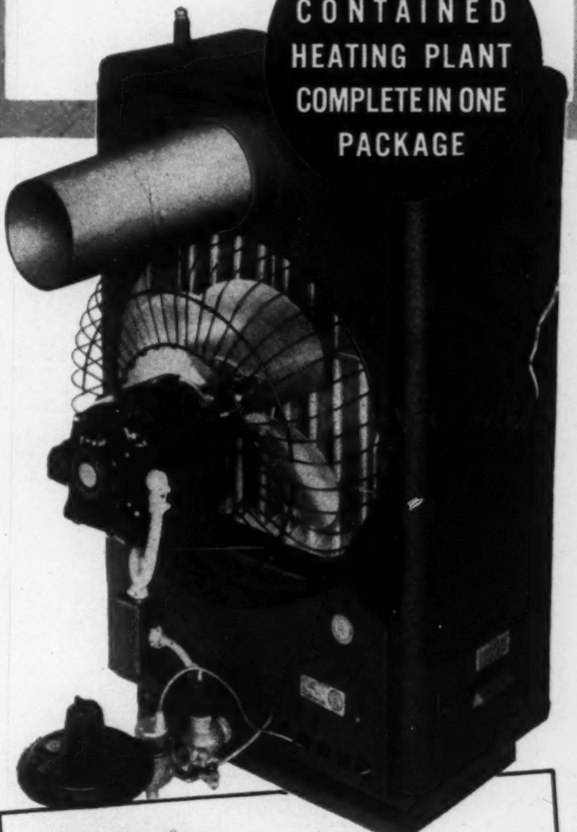
Prefabricated Turning Vanes

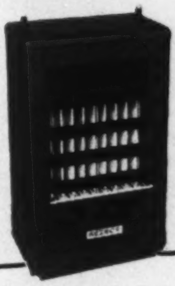
No. 2277—The "Uni-Flo Elturn" is used in duct systems to eliminate the necessity of long radius turns and allow right angle elbows throughout. It comprises prefabricated curved turning vanes to provide uniform air flow around and beyond the turn in order to reduce resistance caused by eddies, reverse air flow and low pressure areas. When used at the top of stack heads, it provides straight and uniform air delivery to the



NOW AVAILABLE

REZNOR Suspended Gas Fired Unit Heaters . .





In over 135 Army and Navy establishments and in plants of countless war contractors

From a suspended position, Reznor unit heaters distribute clean, uniform, automatic heat over wide areas. Installations and deliveries save days and often weeks. Reznor gas heating REQUIRES 89% LESS VITAL MATERIALS than any other type of system. Write today for data on a complete range of sizes.

REZNOR MFG. CO. 305 James St., Mercer, Penna.

"GAS HEATERS EXCLUSIVELY SINCE 1888"

Níagara NO FROST Method

Saves Money

This new improved way to protect quality in fresh or frozen foods, correctly diffuses cold air at the right condition for rapid, effective cooling. Its constant full capacity is never decreased by progressive icing of coils or interrupted for defrosting in temperatures as low as −50° F. It saves refrigeration, saves power, saves equipment cost.

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6 E. 45th St., New York City
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Sales Engineers in Principal Cities

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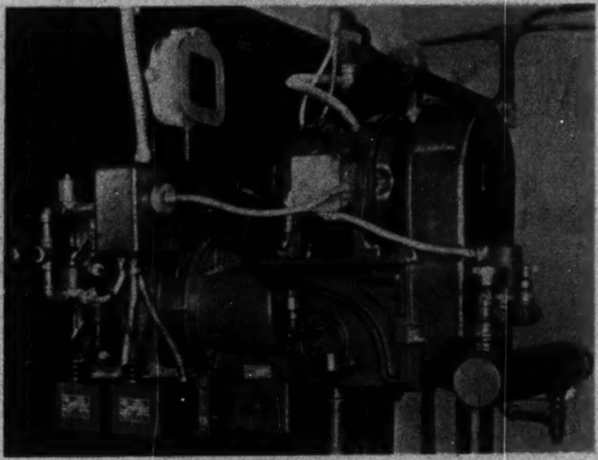
HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Consult Enterprise Burner Distributors

For Heating Economy With Enterprise Heavy Oil Rotary Burners



Our Distributors are expertly equipped to make recommendations for firing Power or Heating Boilers, Dryers, Kilns, Ovens and the myriad applications for heat and power uses in industry and the needs of our Army, Navy and Air Force.

Sizes 12 to 650 Boiler HP. Gravity or pump feed; manual, semi, full automatic; combination gas-oil; for burning heavy bunker fuel oils to meet the most exacting specifications of a particular installation.

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outlet, the manufacturer states.

It is available in sizes up to and including 48 in. by 48 in. Larger sizes are prefabricated in two or more sections assembled into a single unit by clamps.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Unit Heater Thermostat

No. 2278—A new line voltage, two wire thermostat incorporating "on" and "off" positions on the calibrated dial is designated as the "872A11" series. It is especially suitable for industrial and commercial unit heater application, according to the manufacturer.

In addition to performing the regular automatic function of the average thermostat, it permits manual control of the unit heater motor. For example, if the unit heater is near loading doors in a manufacturing plant, the thermostat dial can be moved manually to the off position to prevent operation during the period when doors are open. This feature also acts as a convenient service switch or may be used to shut down the unit heater during idle periods or at night. For summer fan operation, the dial can be moved to the on position, causing the unit heater motor to run continuously for ventilating purposes.

Heat anticipation for close temperature control is provided.—Penn Electric Switch Co., Box 556, Goshen, Ind.

Ultraviolet Kills Germs in Hospitals

No. 2279—The successful use of ultraviolet as a germicidal agent has led the American Medical Association to endorse the "Sterilamp" for use in operating rooms, hospital nurseries and isolation wards, the manufacturer announces. Acceptance was based on the association's own tests and on clinical evidence which discloses that the lamps are capable of creating an invisible wall of germ killing light around the beds of patients with contagious diseases, thus preventing the spread of infection.

One of the most outstanding results in the use of ultraviolet for air disinfection is reported at Duke University, where the lamps were first used over operating tables to disinfect the air and to safeguard open wounds during operations. These experiments, conducted by Dr. Deryl Hart over a period of more than five years, almost eliminated post-operative infections. Also contributing in the study were scientists at the University of Pennsylvania school of medicine, who reported that their experiments indicate the possibility of controlling children's contagious diseases by disinfecting the air in schools and other gathering places with ultraviolet.—Westinghouse Electric & Mfg. Co., Bloomfield, N. J.

Dual Pumping Unit

No. 2280—A new combination rotary-centrifugal dual pumping unit is mounted on a cast bedplate and is pow-

YOU ARE THE

Invisible Man

BEHIND THIS GUN

For every Patterson Hot Water Storage Heater you *don't get* today, our fighting forces get an invaluable piece of new equipment. Into the average Patterson heater goes enough steel to make a 105mm anti-aircraft gun. Multiply that in terms of nation-wide heater requirements, and what is the result? Enough long-range A. A. guns to put up a withering curtain of steel against enemy air armadas!

In a very real sense, you and your associates in the heating and air conditioning industry are important members of every anti-aircraft gun crew on land and on sea. Your willingness to do without a new Patterson-Kelley heater . . . your cooperation in getting maximum service out of present equipment puts one more gun on the firing line.

After the war, Patterson-Kelley will again place its engineering and manufacturing facilities at your service. You may rest assured, moreover, that your post-war Patterson Hot Water Storage Heater will be designed and constructed in accordance with past standards of excellence . . . standards of quality workmanship that have made Patterson heaters and coolers standard equipment for heating, ventilating and air conditioning operations. In the meantime, we are confident that your answer and our answer to Axis aggression are one and the same . . . "Keep 'em firing!"

PATTERSON-KELLEY HEAT EXCHANGE ENGINEERS
EST. 1880

PATTERSON-KELLEY *FOR DEPENDABLE ECONOMICAL SERVICE*

THE *Patterson-Kelley* CO., INC.
109 WARREN ST., EAST STROUDSBURG, PA.

PETRO
REG. U. S. PAT. OFF.

OIL BURNING SYSTEMS

are only available—"for duration", on orders carrying high preference ratings.

BUT—

Petro service, parts for necessary maintenance, and engineering consultation and services, are still fully available.

AND—

hundreds of Petro Oil Burning Systems are meeting unprecedented steam demands in war production plants everywhere;

—24 hour operation, far above normal ratings, day after day, week after week;

—a "break down" test on a gigantic scale which Petro equipment is meeting efficiently, economically, reliably, and without breaking down because ample reserve strength and wear has always been built into Petro.

In addition to being proud of such performance, we think it is a good thing for the heating trade to remember against the time when conditions again permit the free selection and installation of normal industrial and commercial firing equipment.

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USE IT WISELY

PETROLEUM HEAT AND POWER COMPANY
Makers of Good Oil Burning Equipment Since 1903
STAMFORD CONNECTICUT

GET THIS HOUR BY HOUR RECORD
Totalized Every Day

KEEP ACCURATE COSTS
for STEAM, WATER
COMPRESSED AIR or GAS

Get the data you need for allocating costs from these direct-reading, evenly-divided charts—recorded with exceptional accuracy at all rates of flow and TOTALIZED on the ADSCO Flow Meter.

Despite its high sensitivity to fluctuation in flow, the ADSCO Flow Meter is so simple and rugged that it cannot be damaged by sudden overloads or reverse flows—is easy to install and maintain.

Available with (1) recording chart, (2) indicating scale and (3) integrator counter to totalize the flow or other combinations thereof. Write us regarding your metering problems—also ask for Bulletin 35-83H.P.

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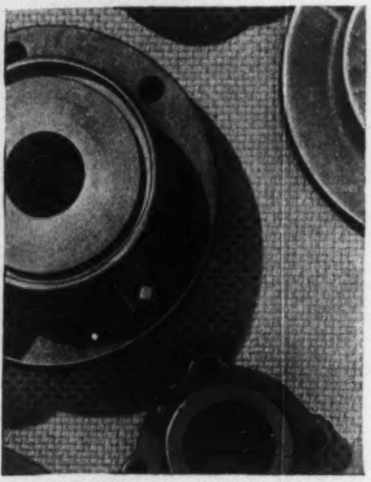
ered by a 4 hp, 3 phase, 60 cycle motor with a gear head on one end to drive a rotary pumping unit, and a shaft extension on the other end connected direct to a centrifugal pump. The rotary pump has a capacity of 44 gpm at 50 psi, handling lube or fuel oil. The centrifugal pump has a capacity of 75 gpm at 25 psi handling water.

In marine and other applications where pumping facilities for both lube or fuel oil and water are required, these units offer a number of advantages. They are currently being used in connection with the war effort on marine craft and in industrial plants on applications where two dissimilar liquids must be handled through one pumping unit.—Blackmer Pump Co., 1809A Century Ave., S.W., Grand Rapids, Mich.

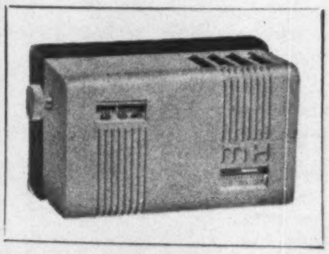
Standard Covers for Bearings

No. 2281—With the approval of leading manufacturers of ball and roller bearings, standard covers (in a complete range of types and sizes) have recently been developed for forming a dust and grease-tight closure to the bearing housing. Low unit cost in small or large quantities, the saving of costly "nuisance" setups, reduction in designing, drafting, detailing and checking time as well as elimination of the costs of patterns, fixtures, gages, etc., are the chief advantages, the maker states.—R-S Products Corp., Germantown Ave., at Wayne Junction, Philadelphia, Pa.



Heavy Duty Thermostat

No. 2282—A new high capacity thermostat has been developed for use wherever two wire or three wire line voltage control is required. It is an electrical version of the horizontal design which the same manufacturer pioneered in pneumatic control. This principle affords maximum air circulation about the element and insures against possible harmful effects of electrical contact heat, it is stated.



The movement of the sensitive vapor filled bellows is transmitted to a "Con-Tac-Tor" snap switch. Because this switch is nonmagnetic in operation, it is not affected by vibration nor by "contact bounce," the maker states. It is fully enclosed to protect it from dirt, dust and grime, and assure long life to the silver contacts.

Applications include unit heaters, water circulators, coal blowers, motorized valves and motorized dampers. It can also be used with a magnetic starter on large or polyphase motors.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., South, Minneapolis, Minn.

WELDOLETS·
TRADE MARKS REG U S PAT OFF
THREDOLETS
. . . Welded Outlets for Piping . . .

Any One or All 3 Will Make Any Right-Angle Welded Branch Pipe Outlet

TEES, Crosses, Side Outlets, Side Outlets and Crosses or Double Crosses . . . any one or all can be made with Bonney WeldOlets, ThredOlets or Socket-End WeldOlets.

Every branch pipe outlet made with a WeldOlet, ThredOlet or Socket-End WeldOlet will provide a leakproof junction of full pipe strength that reduces friction and turbulence to a minimum.

No templets are required for cutting the hole in the main pipe . . . no complicated forming or fitting is necessary . . . alignment of the main and branch pipes is simplified. The position of the outlet is selected and the WeldOlet, ThredOlet or Socket-End WeldOlet welded in place . . . the hole in the main pipe, in most cases, being made after the fitting is installed.

Bonney WeldOlets, ThredOlets and Socket-End WeldOlets are stock fittings of drop forged steel with outlets from 1/4" to 12". On special order they can be furnished in sizes up to 24" x 24". To meet special conditions they can also be supplied in wrought iron, Toncan Iron, brass, Monel, Everdur, etc. They are adaptable to every type of piping system and for all commonly used pressures and temperatures.

Your local distributor will be glad to give you complete information or write for Bulletin WT29 describing all their advantages.

WELDOLET

THREDOLET

Socket-End WELDOLET

EASILY INSTALLED

Mark center lines and tack the fitting into place.

Then weld the fitting to the main pipe.

Bulletin WT29—20 pages packed with information and data on advantages of WeldOlets, ThredOlets and Socket-End WeldOlets in all types of piping installations. Write for your copy NOW.

Remove the button which will also permit inspection of the inside of the joint.

Then attach the branch pipe.

BONNEY FORGE & TOOL WORKS
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PUT YOUR MONEY ON THE *Heavyweight*

This year of all years, consider W-S High-Pressure, High-Temperature Forged Steel Fittings for *all* your needs—even where pressures and temperatures are only moderate. Because these fittings last far longer, you can thereby insure yourself against replacements in future months when all fittings may be far harder to get.

Service records prove that the extra endurance of these "heavyweight" fittings more than outweighs their additional cost. That's true economy and true conservation in any year.

Bulletin A-3 gives all facts on the wide available range of sizes and pressure ratings—both welding and screw-end types. Order through your regular Mill Supply Distributor.

THE WATSON-STILLMAN CO.
ROSELLE, NEW JERSEY
Engineers and Manufacturers of Forged Steel Fittings and Valves, Hydraulic Machinery and Equipment—Hydraulic Presses, Pumps and Jacks

2347

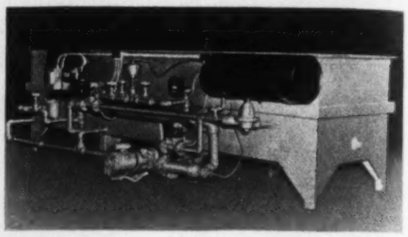
Sensitive Bimetal

No. 2283—An "important contribution to thermostatic bimetal development" was announced last month. Through the use of new alloys recently developed, this new thermostatic bimetal is said to have a decidedly increased sensitivity over previous standard types. The manufacturer says that a reduction up to 40 per cent in weight and mass of a thermostatic element is possible.

Reduction in size of the element not only saves in the amount of material used, but also makes it possible to employ a smaller mounting space.—W. M. Chace Co., 1606 Beard Ave., Detroit, Mich.

Wash Tanks

No. 2284—For manufacturing processes where washing of products is necessary, wash tanks to meet specialized requirements are being built. The illustration at right shows a three compartment tank, specially designed for washing castings in a war production plant.



The castings are successively passed through cold kerosene, hot "Oakite" and finally hot water. The two hot baths are maintained at the proper temperature by water heated in a steam converter and mechanically circulated through coils in the tanks. Operation and con-

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Fundamentals are fully and clearly covered in this volume, as are the newest air conditioning methods and equipment. Correct procedure in designing complete systems for both residences and large buildings is explained step by step from the standpoint of newest practice. In addition, considerable original data on such comparatively new subjects as standards, noise control, measurements, and fire protection codes has been included.

Send $2.00 for a copy today to the address below. We know you will consider this one of the finest air conditioning books you have yet seen, but if you should be dissatisfied with it for any reason whatever, your money will be promptly returned to you.

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trol of temperature is automatic.—Bell & Gossett Co., Morton Grove, Ill.

Promotes Air Conditioning Economy

No. 2285—The installation of a "Dorex" recovery unit in one building of a new plant will result in conserving a large tonnage of metal on the original refrigeration installation and large quantities of electric current and fuel, the manufacturer states. Seven hundred adsorber canisters have been installed in the air conditioned company cafeteria to treat 20,000 cfm of return air. This installation represents a practical application of the theory that conditioned air can be used over and over again if it is rendered fit for consumption, and that only a small amount of new air is required for proper oxygen conditions.

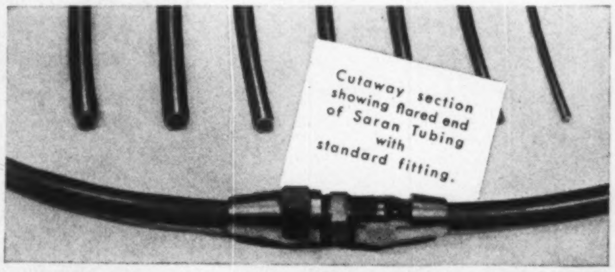
In this plant, the use of the adsorber equipment for recirculation of air has led to the conservation of roughly 50 tons of installed refrigeration, and will later result in saving approximately 45,000 kwhr of electric current per season for cooling purposes and approximately 40,000 gal of oil per season for heating, it is stated. Savings of water will also be effected.—W. B. Connor Engineering Corp., Dorex Div., 114 E. 32nd St., New York, N. Y.

All Wood Culvert

No. 2286—"We'll need 4000 ft of 24 in. drainage pipe," says the highway engineer to the culvert salesman.

"Fine!" replies the salesman, "and what'll you have it in—pine or fir?"

Such "peculiar" talk now may be expected wherever


Cutaway section showing flared end of Saran Tubing with standard fitting.

Use **SARAN**

★

Tubing: Air-conditioning, brine and gasoline, oil refrigerant lines, atomizer tubing, etc.
Molded Parts: Gasoline and fluid floats, diaphragms, gaskets, washers, packings, etc.
Sheets: Food and chemical tank linings, coverings, inlays, engraving plates, etc.

★

To Replace Critical Metals For Pipe and Tubing

Manufacturers of war and civilian materials are finding a wide range of uses for this new thermoplastic. It has extreme chemical resistance, high tensile strength. Saran tubing is flexible, semi-transparent, and resists acids, alkalies, brine, etc. Replaces metal tubing except for high temperatures. Available in sheets of various thicknesses, in tubing up to ¾" OD., and in some pipe sizes.

SEND *Today* for data sheets and information on applications of Saran

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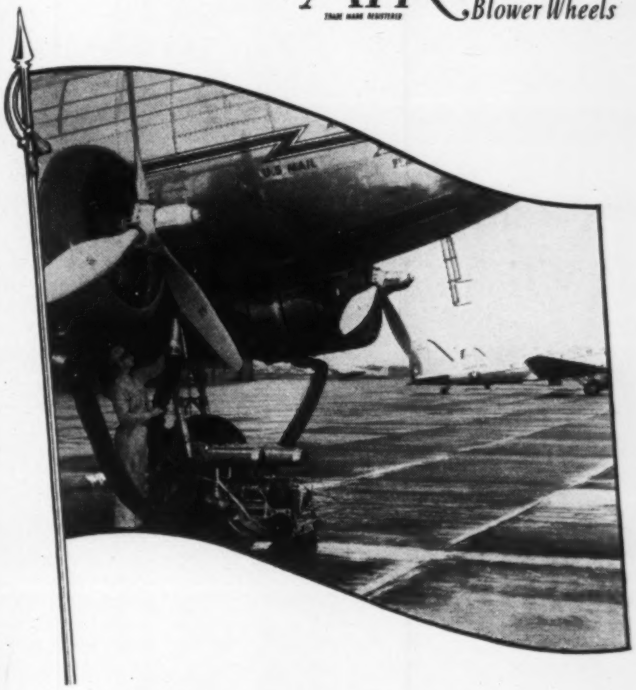
AIR for the United States ARMED FORCES

from AIROTOR Blower Wheels
TRADE MARK REGISTERED



HERE is another unit in which Torrington Airotor Blower Wheels are serving our armed forces and the public.

The portable "ground heater" illustrated is used by the Army Air Corps and by commercial air lines for preheating airplane engines and cabins, saving much valuable aviation gasoline previously required for warming up engines on the ground. The Airotor Blower Wheel drives heated air through flexible hose to special connections under the plane.

Only a sturdy and carefully balanced fan will withstand this high speed gasoline engine application, yet the Airotors used are of our standard design from regular production.

The proper Airotor for each application may be easily selected from our dependable performance charts. Free samples will be supplied for further test.

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DIRECTHERM
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★ HEATER ★
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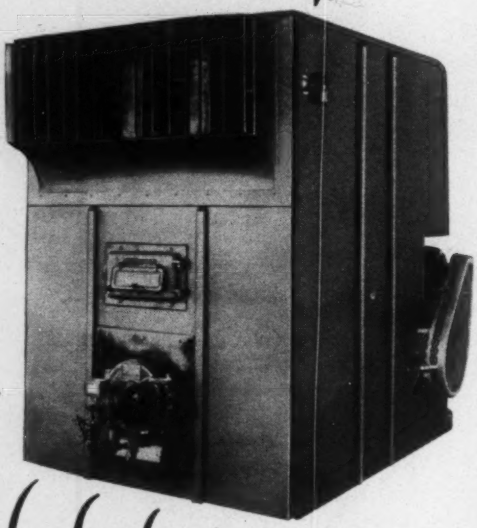


"TURNS ON THE HEAT"
ON WAR PRODUCTION

IF YOU work for Uncle Sam, you will have to solve your heating problem quickly and efficiently. There is no time for laying ducts, pipes, and for complicated installations. Uncle Sam can't wait.

Directherm Heaters are self-contained units. They can be installed in a jiffy, and they utilize 80% of the fuel energy—just the right thing for war production plants.

Our ability to serve you depends on your priorities.

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. ST. LOUIS, MO.

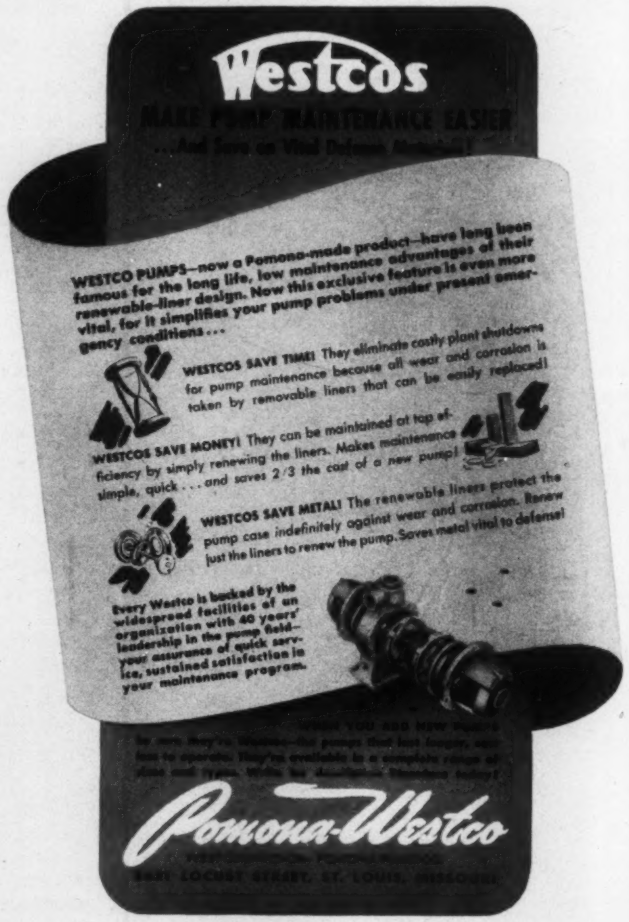
drainage work cannot wait for the return of iron and steel to peacetime uses. A major steel producer has designed an all wood culvert that does not require steel bands, nails or metal reinforcing of any kind.

Company officials explain that where engineering integrity demands it, corrugated metal drainage pipe may yet be used on vital war projects.—The American Rolling Mill Co., 703 Curtis St., Middletown, Ohio.

Float Controls

No. 2287—Two new series of float controls for starting and stopping electric motors by changes in liquid level have been recently announced. The "152" series is available in two pole construction while the "110" series may be had in single, double or three pole construction. In either series, the float controls may be reversed from open tank to sump operation (or vice versa) simply by changing pivot location of the operating arm lever.

Among the features incorporated in these float controls, states the manufacturer, are the following: Contact structure is heavy duty, double break design and is actuated by an exclusive "V-over-roller" trip mechanism; contacts are of electrolytic silver and are completely accessible without dismantling any part of the control; operating parts are hardened for long life; close fitting, watershed type cover can be removed easily for wiring and service; any model is adjustable for sump or open tank operation; and contacts are mounted in deep channeled plastic block to assure freedom from arcing and flashovers.—Penn Electric Switch Co., Box 556, Goshen, Ind.



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MAKE PUMP MAINTENANCE EASIER

WESTCO PUMPS—now a Pomona-made product—have long been famous for the long life, low maintenance advantages of their renewable-liner design. Now this exclusive feature is even more vital, for it simplifies your pump problems under present emergency conditions...

WESTCOS SAVE TIME! They eliminate costly plant shutdowns for pump maintenance because all wear and corrosion is taken by removable liners that can be easily replaced!

WESTCOS SAVE MONEY! They can be maintained at top efficiency by simply renewing the liners. Makes maintenance simple, quick . . . and saves 2/3 the cost of a new pump!

WESTCOS SAVE METAL! The renewable liners protect the pump case indefinitely against wear and corrosion. Renew just the liners to renew the pump. Saves metal vital to defense!

Every Westco is backed by the widespread facilities of an organization with 40 years' leadership in the pump field—your assurance of quick service, sustained satisfaction in your maintenance program.

Pomona-Westco

LOCUST STREET, ST. LOUIS, MISSOURI

Coming Events

Refrigeration

American Society of Refrigerating Engineers: Spring meeting, June 7-9, Skytop Club, Skytop, Pa. Papers scheduled for presentation June 8 include dry blast conditioning, by R. V. D. Dunne; blast furnace conditions due to blackout, by C. B. Morrison; and relations of the refrigeration industry with the War Production Board, by J. M. Fernald. Headquarters office of the ASRE is at 50 W. 40th St., New York, N. Y.

Mechanical Engineering

American Society of Mechanical Engineers: Semi-annual meeting, June 8-10, Hotel Statler, Cleveland, Ohio. Program includes a symposium on domestic fuels; and papers on use of overfire air in stoker fired units, by H. C. Carroll; corrosion of stressed alloy steel bars by high temperature steam, by H. L. Solberg, A. A. Potter, G. A. Hawkins and J. T. Agnew; and an improved technique for rolling in of small tubes used in heat exchangers, except boilers, by F. F. Fisher and E. T. Cope. Headquarters office of the ASME is at 29 W. 39th St., New York, N. Y.

District Heating

National District Heating Association: Annual meeting, June 11-12, Dayton Biltmore Hotel, Dayton, Ohio.

STOP that.. DRIP!

Just what you've been looking for—something easy to apply to pipes, tanks, walls, ceilings, air ducts and other surfaces subject to sweating or condensation drip.

NoDrip

A SURE CURE

This plastic cork coating is applied with a whisk broom, brush or trowel to metal, concrete, brick, wood, plaster, composition, etc. Insulates and prolongs life of pipe or any metal by preventing rust and corrosion. Produces a permanent, stucco-like finish that requires no maintenance. Can be painted any color. A gallon covers about 30 ft. of 1" O. D. pipe. Comes in 1, 5 and 55 gal. drums.

Order from your supply house or write for circular.

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SMALL IN SIZE... but a BIG RESPONSIBILITY!

A-P Valves help Keep Refrigeration Equipment in steady, "service-free" operation for protection of foods and materials.

But, to help one another, we know the Refrigeration Industry will cooperate in our War effort by buying A-P Valves and other parts, ONLY AS NEEDED. For stocks of these Wartime essentials must be "stretched" as far as possible to conserve man power and materials for "Weapons of Victory."

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Yours is a job important to keep food products available to Military and Civilian use with a minimum of replacement materials.

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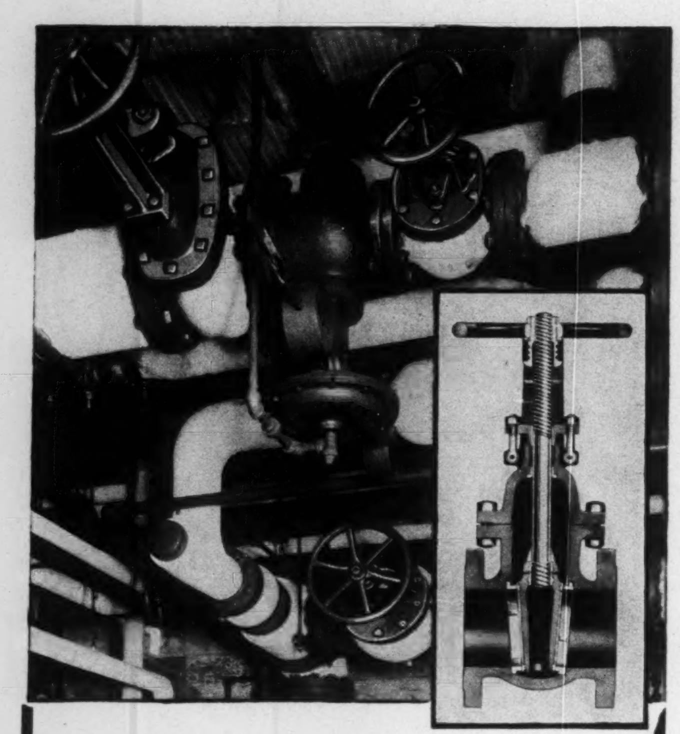
AP DEPENDABLE Refrigerant Valves



Minimize Service Interruptions

Many years of actual experience with Fairbanks Valves having proved that they eliminated interruptions previously experienced, a leading college installed Fairbanks Valves in their new power house illustrated above.

Here are some of the reasons why men *who know* like Fairbanks Iron Gate Valves.

Acme threads assure easy operation and great strength . . . deep stuffing box with hinge bolts gives easy access for repacking . . . top seat permits packing under pressure when fully open . . . reversible tapered wedge with guide ribs, assures perfect alignment . . . renewable seat rings without threads permit quick and easy renewal without removing valve from the pipe line.

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Fairbanks
Standard and Renewable Valves

Headquarters office, 827 N. Euclid Ave., Pittsburgh, Pa. John F. Collins, Jr, is the secretary.

Heating and Ventilating

American Society of Heating and Ventilating Engineers: Summer meeting, June 15-17, Hotel St. Paul, St. Paul, Minn. For further information, see ASHVE Journal Section. Secretary of the ASHVE is A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Materials Testing

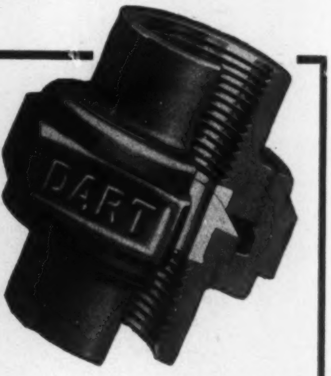
American Society for Testing Materials: 45th annual meeting, Chalfonte-Haddon Hall, June 22-26, Atlantic City, N. J. A symposium on radiography and a discussion on solvent action of water vapor at high pressure and temperature are features of the program. Headquarters office of ASTM is at 260 S. Broad St., Philadelphia, Pa.

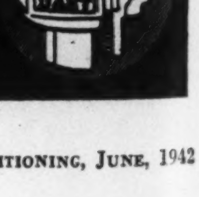
Industrial Advertising

National Industrial Advertisers Association: 20th annual conference to be held at Atlantic City, N. J., in September. Fred H. Pinkerton, United States Rubber Co., is general chairman of the conference.

Welding

American Welding Society: Annual meeting, October 12-16, Detroit, Mich. The sessions are being planned to assist in the war effort. Headquarters office of the AWS is at 33 W. 39th St., New York, N. Y.





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We are continuing to recommend to manufacturers that they put their "retired" Dart Unions back to work . . . and we suggest again that when you are out selling new Darts, you make the *same* recommendation.

Darts pay extra dividends in performance and service life. Their matched bronze seats, ground to "true-ball" surfaces make it possible for Darts to be used again and again, with "first-time tightness." Dart bodies and nuts are made of air refined malleable iron which explains why Darts can take rough handling, resist corrosion and pipe strains.

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Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 109. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Bacteria and Corrosion Control

No. 4184—16 p. booklet on "Airefiner" for bacteria control in air conditioning, "an improvement that makes good air better, protects equipment against corrosion, prevents slime growth." Bacteria control is discussed in some detail, causes of corrosion and how it may be prevented are described, and odor control is discussed. There is a special section on cleaning textile mill humidifying systems, and numerous suggestions for application of this product.—Oakite Products, Inc., 22 Thames St., New York, N. Y.

Blowers

No. 4185—76 p. catalog (303) describing type "H" and "HB" centrifugal blowers, divided into two sections, the first of which is a 20 p. bulletin illustrated with photographs showing various drive arrangements and discharges in both single inlet, single width and in double inlet, double width construction. Construction features, performance characteristics, etc., for forwardly curved and backwardly curved blades are discussed and

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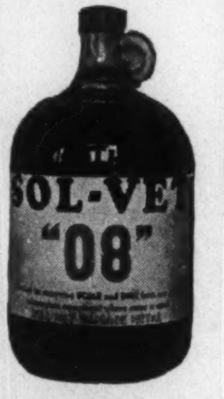

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Basically mineral, this time-tried J-M Material provides these five essential features in every refrigerated service . . .

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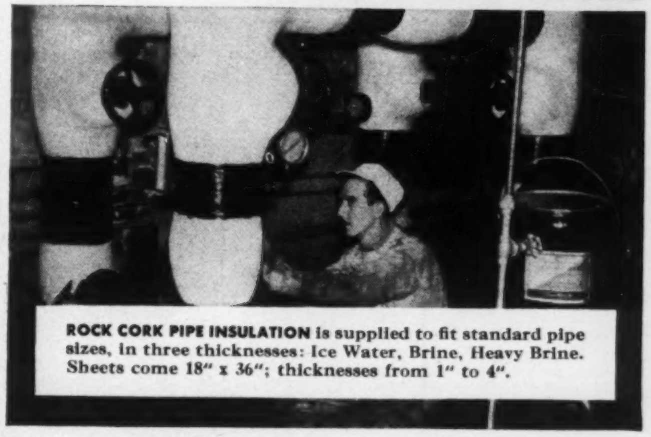

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applications described. Part 2 of the catalog consists of 40 pp. of engineering data and capacity tables covering performance at static pressures from ⅛ to 5 in. and with 16 pp. of dimension drawings containing 78 different views.—Autovent Fan & Blower Div., The Herman Nelson Corp., 1811-27 N. Kostner Ave., Chicago, Ill.

Blowers

No. 4186—Bulletin (388-A) giving dimensional and performance data for various static pressures on single inlet blowers from 5 in. up to 9 in. diameter, and including a series of 16 drawings showing types of discharges. These blowers may be obtained with direct drive or with belt drive, and come equipped with either a-c or d-c motors.—Lau Blower Co., 2001 Home Ave., Dayton, Ohio.

Condensate Return Units

No. 4187—4 p. bulletin (200) on single and duplex condensate return units with dimension and rating tables, installation drawings and sample specifications.—Ames Hydrovac Corp., 290 Scholes St., Brooklyn, N. Y.

Conservation for Victory Program

No. 4188—4 p. mailing piece featuring the refrigeration and air conditioning industry's new program for victory through saving critical materials, simplifying design and by substitution. Practical suggestions for cooperating in the program are given in a pledge printed on the first page and typical controls made by the manu-

For heavy duty operation in commercial applications, the unusual simplicity in design of

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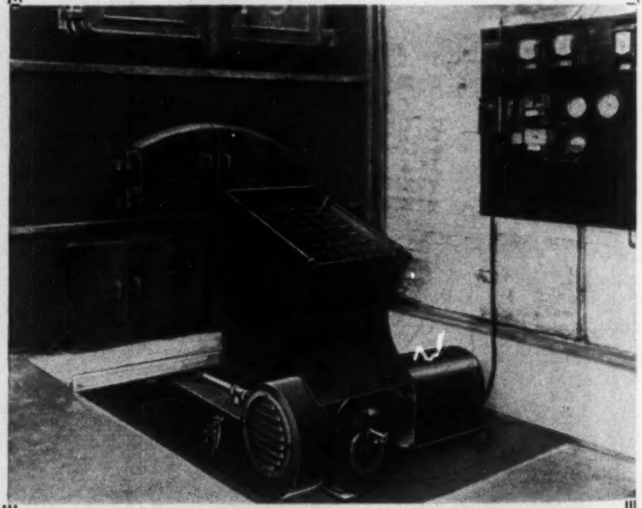
has decided advantages—well demonstrated in 24 years' use—pertinent to your problem today. Ask about its remarkable record. No obligation.



THE FREDERICK IRON & STEEL CO.
"Builders of Good Stokers for 24 Years"
East & Seventh St., Frederick, Maryland

facturer are illustrated and briefly described on the inside pages. Copies of this mailing piece have been sent to all of the manufacturer's refrigeration manufacturing, distributor and jobber customers urging them to mail the folders to their service engineers. The manufacturer also offers to imprint these broadsides and furnish them free for its customers.—Penn Electric Switch Co., Box 556, Goshen, Ind.

Direct Fired Heaters

No. 4189—4 p. bulletin describing direct fired heater available for quick delivery in sizes from 700,000 to 1,500,000 Btu. This heater is a self-fired unit containing its own combustion chamber as well as the motors and fans to circulate warm air in the space to be heated. Also, 2 p. leaflet giving a partial list of users of these units.—Dravo Corp., Dravo Bldg., Pittsburgh, Pa.

Electrical Equipment

No. 4190—64 p. "Quick Selector" catalog (30-000) covering safety switches and fusible service equipment, "nofuze" breakers, multibreakers, panelboards, motor controls and motors. Electrical ratings, physical dimensions and circuit diagrams expedite the selection of correct equipment for each purpose.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Fans

No. 4191—28 p. catalog (X4549) on fans of the desk and floor stand types, including air circulators for busi-

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1. A prepared pipe cement which *expands as it sets*. X-Pando is not a "thread dope." One formula for all uses.
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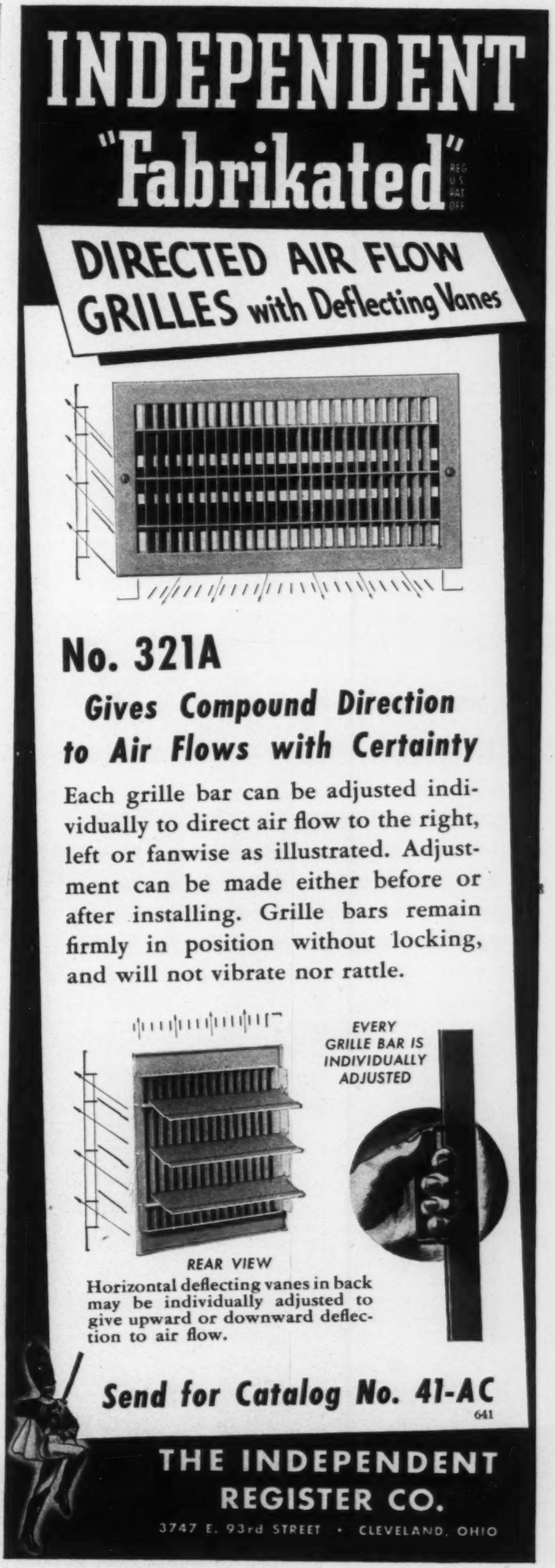
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DIRECTED AIR FLOW GRILLES with Deflecting Vanes

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Gives Compound Direction to Air Flows with Certainty

Each grille bar can be adjusted individually to direct air flow to the right, left or fanwise as illustrated. Adjustment can be made either before or after installing. Grille bars remain firmly in position without locking, and will not vibrate nor rattle.

EVERY GRILLE BAR IS INDIVIDUALLY ADJUSTED

REAR VIEW

Horizontal deflecting vanes in back may be individually adjusted to give upward or downward deflection to air flow.

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CHROMALOX

Electric Strip Heaters permit summer shutdown of three 150 hp. steam boilers by taking their place as the source of heat for this conveyor type paint drying oven. Think of the saving! The strip heaters are mounted in removable angle iron frames across the bottom of the oven, and temperature is thermostatically maintained at 300 degrees F. Results have been very satisfactory, including uniformity of finish, cleanliness and absence of fire hazard.

In the development of installations like this, the aid of Wiegand electric heating experts is offered without reserve. They can tell you the units which will do your job for you. Chromalox catalog on request.

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ness and industry, ceiling fans, exhaust fans, window type fans, and accessory equipment. Also, a leaflet (X4563) on the importance of ventilation in industrial, commercial and institutional buildings.—Emerson Electric Mfg. Co., 1847 Washington Ave., St. Louis, Mo.

Gas Burners

No. 4192—6 p. folder on "Glowan" gas burners, describing their unit design and giving capacities, specifications and sectional views of installations. A representative list of installations in various types of buildings is appended.—J. O. & C. U. Martin, 637 Minna St., San Francisco, Calif.

Humidity Control

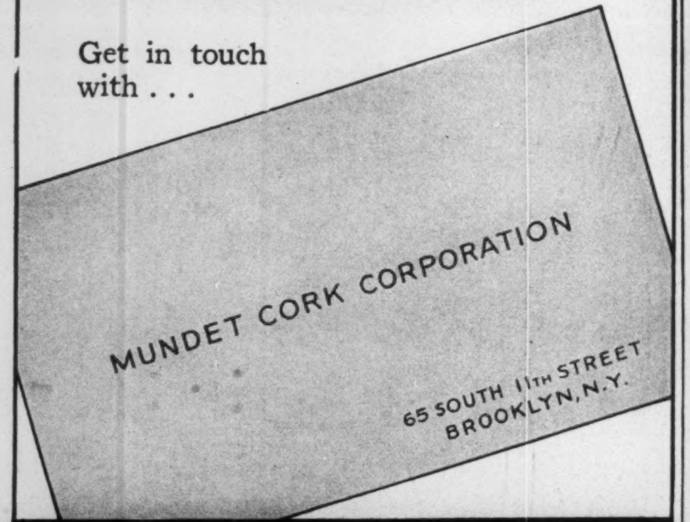
No. 4193—20 p. booklet on planning humidity control in industrial processing applications, product drying operations and comfort air conditioning for industry, using rotary silica gel dehumidifiers. The advantages of independent humidity control are described and illustrated, and there are drawings and discussions of typical applications of the dehumidifiers as part of a conventional air conditioning installation, for eliminating the need for a reheat coil, for giving independent humidity and temperature control, for very accurate control of humidity and temperature, for low moisture processing and for product drying operations. Specifications for these rotary type dehumidifiers are tabulated.—Bryant Heater Co., 17825 St. Clair Ave., Cleveland, Ohio.

Instruments and Controls

No. 4194—16 p. publication entitled Modern Precision (Vol. 2, No. 1) of general interest to engineers, research

When You Need Information on Insulation . . .

Get in touch with . . .



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. . . reflecting the fine craftsmanship and design that have characterized Waterloo products for over 40 years.

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CONTROL OF SELECTION SIZE THROW VOLUME DIRECTION

scientists, executives, and users of electrical instruments, controls and furnaces. It contains news of instruments, controls and heat treating methods, and of the jobs they are doing in industry, in laboratories and in teaching and testing.—Leeds & Northrup Co., 4970 Stenton Ave., Philadelphia, Pa.

Insulation

No. 4195—8 p. bulletin on insulation, which is applied by spray gun, for industrial and commercial buildings, ventilating ducts, storage tanks, dryers, filters, cold storage rooms, etc. Typical applications are illustrated and engineering data are presented on the thermal properties of the product and its uses in condensation control and noise reduction as well as in preventing heat flow.—Sprayo-Flake Co., 2715 Irving Park Blvd., Chicago, Ill.

Insulations

No. 4196—16 p. bulletin on the manufacturer's insulations for industry, which include block insulation, rock wool blanket, fill material, pipe covering, insulating cement, felt insulation, "Koldboard," weatherproof protection, miscellaneous insulation and building insulation. The properties of the various types and their uses are described and illustrated in detail.—Baldwin-Hill Co., 527 Klagg Ave., Trenton, N. J.

Lock Nuts

No. 4197—6 p. folder describing "An-cor-lox" lock nuts, which are available in numerous materials, designs and finishes, and including application instructions.—Laminated Shim Co., Inc., 84 Union St., Glenbrook, Conn.

DOES NOT STAIN HANDS or FIXTURES

Take a tip from other master plumbers and use Rutland Pipe Joint Cement on every job. It seals joints tightly—lasts indefinitely—yet always leaves pipes easy to disjoin. Legal for use in all cities because no toxic ingredients. Remains soft in can.
Mail post card for free ample. Rutland Fire Clay Company, Department H-6, Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patcher.

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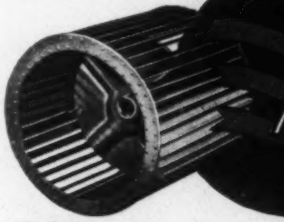

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LAU BLOWER WHEELS are being applied to a wide variety of equipment vital to America's war offensive.

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Let Lau help you with your air-handling problems.

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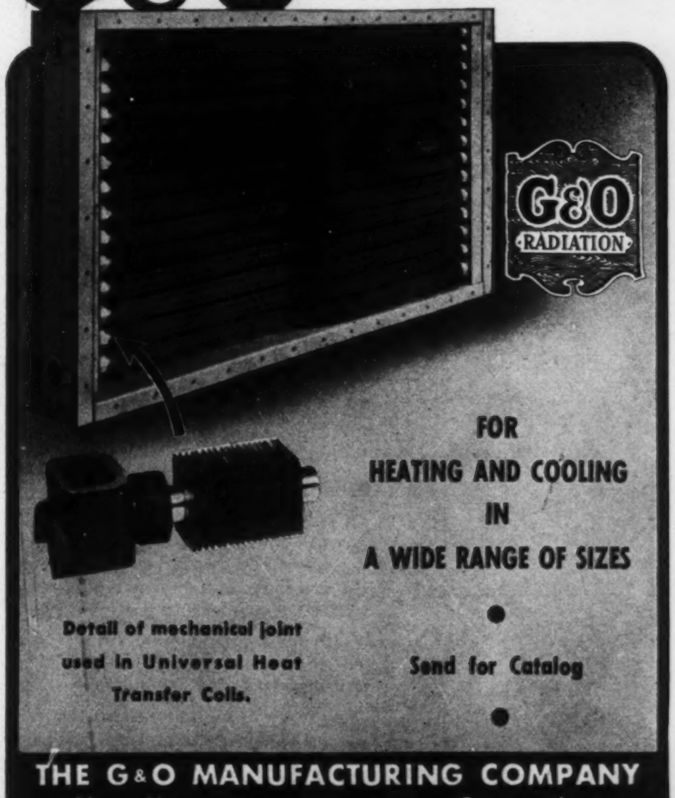

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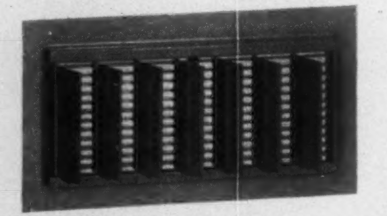

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Made in sizes and types for all requirements. Ask for Bulletin N-615.

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Pipe Threading

No. 4198.—Folder on how to get better threading results on pipe, including notes on grinding dies, cutting angles on various types of chasers, recommended cutting angles and cutting speeds for various pipe materials, and defining terms applying to threading dies and their functions.—Republic Steel Corp., Republic Bldg., Cleveland, Ohio.

Rotary Pumps

No. 4199—6 p. bulletin (301) explaining the principle and operation of rotary pumps, showing a typical capacity curve and illustrating details of construction and various available types.—Blackmer Pump Co., 1809A Century Ave., S.W., Grand Rapids, Mich.

Sealing and Caulking Compound

No. 4200—4 p. folder describing "Duxseal" all purpose sealing and caulking compound. Uses include the sealing of duct openings, sealing against gas leakage, caulking steel window frames, caulking around riser pipes and numerous miscellaneous uses.—Johns-Manville, 22 E. 40th St., New York, N. Y.

Stokers

No. 4201—Bulletin describing and illustrating the pneumatic spreader stoker, covering the pneumatic spreader principle, the four major units of such a stoker, automatic control of combustion and of stoker operation, engineering of stoker installations and the models and types of pneumatic spreader stokers available. There are also photographs, drawings and design figures for numerous installations in various types of industrial plants and in a central heating plant.—Iron Fireman Mfg. Co., 1321 W. 106th St., Cleveland, Ohio.

Valves

No. 4202—32 p. bulletin (E100) on valves for boiler room service, describing quick operating valves for blow-off, water columns and other purposes. The text is topically arranged for quick reference and explains in detail the features of the manufacturer's unique designs. —Everlasting Valve Co., 49 Fisk St., Jersey City, N. J.

Welding

No. 4203—8 p. bulletin on a-c welding, featuring the preheating-welding-normalizing use of 60 and 240 cycle a-c current "to alloys not otherwise field weldable." This system—the "Smith-Dolan" system—consists of preheating with a-c hysteresis induction coils which are wrapped around the metals to be welded on either side of the joint. Welding is simplified because it is not necessary to remove the wrapped coils during welding.—Electric Arc, Inc., 152 Jelliff Ave., Newark, N. J.

Welding

No. 4204—18 p. bulletin describing the "Fleet-Fillet" welding technique for speeding war production, designed to be a ready reference booklet for production officials, welding operators and others concerned with welding. According to the manufacturer, this new technique permits faster weld production without increasing operator fatigue, reduces the amount of welding electrode per foot of weld and lowers welding costs.—Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

THE EDITOR'S PAGES

* * *

BOB WETTSTEIN LEAVES HPAC FOR NAVY DUTY

R. Payne Wettstein, secretary of the Keeney Publishing Co. and a member of HPAC's advertising staff, has received his commission as a lieutenant (D-V-P) in the U. S. Naval Reserve and has been ordered to report for active duty this month. We know his friends throughout the industry join with his colleagues on HPAC in wishing him every success in his new work —and a speedy return to us all at the conclusion of the war.

* * *

IMPROVE PLANT HEALTH CONDITIONS FOR VICTORY

Six high officials charged with increasing American war production have appealed to war production drive committees to keep the American workman fit and healthy to save man hours for victory. Their joint statement was sent to each labor-management committee in the more than 800 plants which are participating in the war production drive.

The statement recommended that every medical and engineering means of sickness and accident prevention be provided in plants to make them healthful working places. If a plant is not already conducting a sound industrial hygiene program, the United States Public Health Service, Washington, D. C., should be written for advice.

SUGGEST THAT CONTRACTORS PREFABRICATE SHIP PIPING

The possibility that heating, piping and air conditioning contractors throughout the country may be able to take a much greater part in the shipbuilding program was suggested at the annual convention of the Heating, Piping and Air Conditioning Contractors National Association, held recently in Milwaukee. The proposal, which is being given further study to determine its practicality, would involve widespread prefabrication of piping assemblies in contractors' shops, which would relieve much of the pressure at the shipyards.

A resolution on air conditioning presented to the convention stated that the contractor should refuse assuming the liability for the performance of an installation unless he has had the opportunity of revising the specifications or plans or both as in his opinion is required by the performance guarantee.

The new president of the HPACCNA is George P. Nachman. Daniel Hayes is the vice-president, and L. F. Hudepohl is treasurer. New directors are William H. Driscoll, James Anderson, Roy M. Getschow, A. W. Jordan, and Arthur F. Nass. Joseph C. Fitts was re-elected secretary.

DEFER MEETINGS NOT RELATED TO WAR EFFORT

Deferment for the duration of all meetings, conventions, and group tours which are not closely related to furtherance of the war effort was called for last month by Joseph B. Eastman, director of defense transportation. Attendance at meetings which are closely related to the war program should be skeletonized, Mr. Eastman said.

Vacations should be staggered throughout the year, he said, and vacation travel should be scheduled so that trips would neither start nor terminate on weekends. Private passenger cars should not now be used for extensive vacation travel.

L-38 ORDER RELAXED SOMEWHAT

Manufacturers and distributors of industrial and commercial refrigeration and air conditioning equipment are afforded some degree of relief from the restrictions imposed by limitation order L-38, by amendment No. 1 to the order.

Main provision of the amendment permits sale of certain items of equipment listed under paragraph (e) of the order, with the exception of draft beer coolers, without the necessity of obtaining preference ratings to cover the installation of the finished product. Under the order as originally issued, such items could be sold only on A-9 or higher ratings or to agencies in a preferred order group. Added to the preferred order group are Army exchanges, Navy ship stores, officers' messes and officers', non-commissioned officers' and enlisted men's clubs.

Repair parts are defined, and excluded from the provisions of the order and may now be sold without preferred status.

Manufacturers having fabricated parts and sub-assemblies may now assemble these into finished products, if no further raw materials are consumed in the process. This provision, however, does not affect items in paragraph (e).

All appeals for relief from the stop production provisions of the order must be made on form PD-520.

Commenting on the amendment, Sterling F. Smith, chief of the planning and requirements section of the air conditioning and commercial refrigeration branch and administrator of the order, said that there will be no further relaxation of the prohibition against sales without rated certificates. Installation of such essential equipment as industrial air conditioning may be made only on rated orders. Applications for priority assistance must be made by the ultimate user on form PD-1A.

AWARDS WAR STAMPS FOR BEING ON TIME

Whipping new action into its war production drive, the Bullard Co. announced last month that it will distribute approximately $30,000 worth of war savings stamps weekly among its employees as a reward for prompt, regular, and continued attendance. The sum represents the 10 per cent premium that will be paid on all wages, including overtime, for employees who report for duty on time daily, and work their full schedule of hours for the week.

Employees themselves are buying thousands of dollars worth of bonds weekly through the Treasury Department's payroll allotment plan but the announcement cautioned that the firm "wishes to emphasize that this plan does not relieve anyone of his responsibility to purchase war bonds through the regular payroll deduction plan."

THE EDITOR'S PAGES

Continued

MANY "SUBSTITUTES" HERE TO STAY

Many of the "substitute" or "alternative" materials being used today because of war shortages are undoubtedly here to stay. Frequently, a new material is found to have advantages not possessed by that formerly employed—advantages which might have remained unused were it not for necessity.

A jeweler friend of ours mentioned a case in point the other day. He had employed iridium as an alloying element to harden platinum, although ruthenium is in some ways more satisfactory. His customers, however, usually asked, "Is it iridium platinum?", and because of this demand he felt it inadvisable to switch. Now, he uses ruthenium and believes that he will continue to do so when wartime scarcities are no more.

A. B. Schellenberg, president of Alco Valve Co., recently pointed out that we will be better manufacturers after the war because of the great amount of experience with new materials, redesign of products made necessary by shortages of critical materials, and the requirements being met in producing for victory. This experience should have a tremendous effect on practice in all fields—including heating, piping and air conditioning.

OFFICE AIR CONDITIONING NOT JUST A LUXURY

Air conditioning for industrial processing operations has never been thought of as a luxury, for the need of controlling the temperature, the humidity and the other conditions of the atmosphere which affect materials is easily seen. Many modern manufacturing processes couldn't be carried on at all without such control. Others could be accomplished only at greatly increased cost or with tremendously lowered efficiency were air conditioning not employed.

Air conditioning for comfort, however, has often been thought of as in the straight luxury classification. With the ever-increasing uses of air conditioning in the production for victory program, it becomes more and more evident that even the comfort applications are necessities rather than luxuries (depending, of course, upon whether or not the use of the space conditioned contributes to winning the war).

The need for air conditioning to provide comfortable conditions for workers in the windowless—and other—war production plants is frequently self-evident. In drafting rooms, too, comfort air conditioning is often vital to efficiency and to protect drawings; this application is specifically recognized in the WPB's limitation order L-38.

Another example of comfort air conditioning which is not a luxury is office space, where the occupants are engaged in the war effort. Particularly where there are numerous business machines whose motors contribute heat to the room, and where lighting loads amount to, say, five watts per square foot and more, air conditioning with refrigeration becomes essential. Otherwise, air volumes for ventilation too large to be practical would often be required to remove the heat in order to maintain bearable room temperatures.

AWARDS WAR BONDS FOR PLANT SUGGESTIONS

Young Radiator Co. awarded war savings bonds and stamps to several employees at a recent "volume for victory" meeting as rewards for contributing beneficial suggestions to increase the company's production output of war materials.

Fred M. Young, president of the organization, presented the awards and praised particularly Earl Warren, a core assembler in the company's plant, who contributed "the outstanding suggestion of the month." Warren devised an improved method of stacking, storing and salvaging the copper fins for various types of heat transfer units. With copper high on the metals critical list, the savings in copper being effected by Warren's plan are "a valuable contribution to our whole war production effort," said Mr. Young.

PATRON SAINT OF HEATING AND VENTILATING HONORED

If you think titles of engineering and technical papers are sometimes too lengthy and cumbersome, how do you like this?—"The National Committee to Signalize Benjamin Franklin's Continuing Contribution to American Civilization."

This is the jawbreaking name of a group recently organized by the Franklin Institute of Philadelphia and whose purpose hardly needs any further explanation. Perhaps the world's busiest man—he was a scientist, statesman, publicist, printer, educator and business leader, among other things—Franklin found time to make studies in heating practice and methods, solar radiation, and various ventilation or air conditioning fundamentals. He is the official "patron saint" of the heating and ventilating fraternity.

CRITICAL METAL USE IN METERS RESTRICTED

The use of critical metals in the manufacture of water meters was sharply restricted in a WPB order (schedule I to limitation order L-154) issued June 18. No stainless steel or nickel alloys may be used in water meters. Tin is prohibited except as an alloy in copper, and copper and copper base alloys are eliminated from all parts except internal gears and workings. Schedules similar to the one on water meters are expected to be issued later in respect to other auxiliary equipment.

WPB ASKS CONSERVATION OF COLD DRAWN STEEL TUBING

Users of steel tubing were asked last month to limit their consumption of cold drawn seamless tubing to those operations where no substitute is possible. To avert a critical shortage of this tubing in essential war production of planes, guns, bombs, ships, and other vital war products strict conservation must be practiced and substitutes used in every possible case.

In a letter to users of cold drawn tubing, Reese Taylor, chief of the iron and steel branch of WPB, said that substitutes are available and satisfactory for a number of purposes and asked that hot rolled seamless, electrically welded, gas welded, lap welded, or butt welded tubing be used wherever possible.

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1942, HEATING, PIPING & AIR CONDITIONING *and thus keep your records of sources of supply up to date throughout the year... Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.*

Low Temperature Insulation of Glass

No. 2288—A unique cellular glass—made up of thousands of tiny airtight cells and weighing only 1/15 as much as ordinary glass—has been introduced as a permanent addition to the manufacturer's line of low temperature insulating materials.

This new nonpriority product, which presents glass in a form never before manufactured, is known as "Foamglas." It offers permanent insulating efficiency for cold storage rooms in meat packing plants, chemical and food processing factories, refineries, dairy and ice cream plants, breweries, frozen food locker plants, and in various other low temperature fields, it is stated.

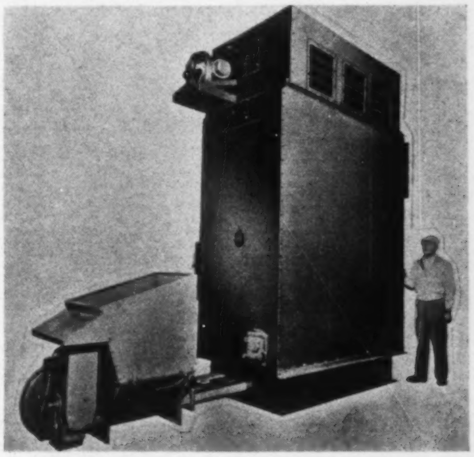
The unusual cellular structure results in the formation of a slight vacuum within the cells that provides a highly efficient barrier to the passage of heat. In addition, this material offers a solution to the moisture problem always prevalent in the low temperature field. Atmospheric pressure tends to force moisture bearing air from the hot to the cold side of insulated construction. When the dew point is reached, moisture is deposited within and on the surface of most insulations, resulting in a loss of insulating efficiency. Since the structure of the new product bars the passage of vapor, maximum efficiency is maintained throughout the life of the construction, says the maker.

This insulation can be sawed and worked with ordinary tools. The material can be shaped for installing on T irons for insulating ceilings by merely rubbing it against the T iron until a perfect fit is attained. It has a wide range of possibilities for use where both insulating value and structural strength are important. As an example of the latter, walls of the material will readily support the insulated ceiling.

This product is manufactured by firing ordinary glass which has been mixed with a small quantity of pure carbon. At the proper temperature, the glass softens and the carbon turns into a gas which then acts upon the molten glass in such a manner that a "cellulated" product is obtained. By proper selection of the glass batch, the type of carbon, and temperature control, it is possible to obtain hard vitreous slabs in which the cells are uniformly small in size and entirely sealed one from another. It is made by the Pittsburgh-Corning Corp. and is marketed exclusively in the low temperature insulation field by the Armstrong Cork Co., 994 Concord St., Lancaster, Pa. It is supplied in one easily erected board size 12 in. x 18 in., in standard thicknesses of 2, 3, 4½ and 6 in.

Direct Fired Coal Burning Heater

No. 2289—Restrictions on the use of oil and gas for fuel in certain parts of the country have aroused interest in a new direct fired coal burning heater. It is equipped with an underfeed stoker of either bituminous or anthracite type and either hopper or bin feed, and is also available for hand



For Your Convenience

[7-42]

HEATING, PIPING & AIR CONDITIONING,
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature." (*Circle each number in which you are interested*):

2288	2289	2290	2291	2292	2293	2294	2295	2296	2297
2298	2299	2300	2301	2302	2303	2304	2305	2306	
4205	4206	4207	4208	4209	4210	4211	4212	4213	4214
4215	4216	4217	4218	4219	4220	4221	4222	4223	4224
4225	4226	4227	4228						

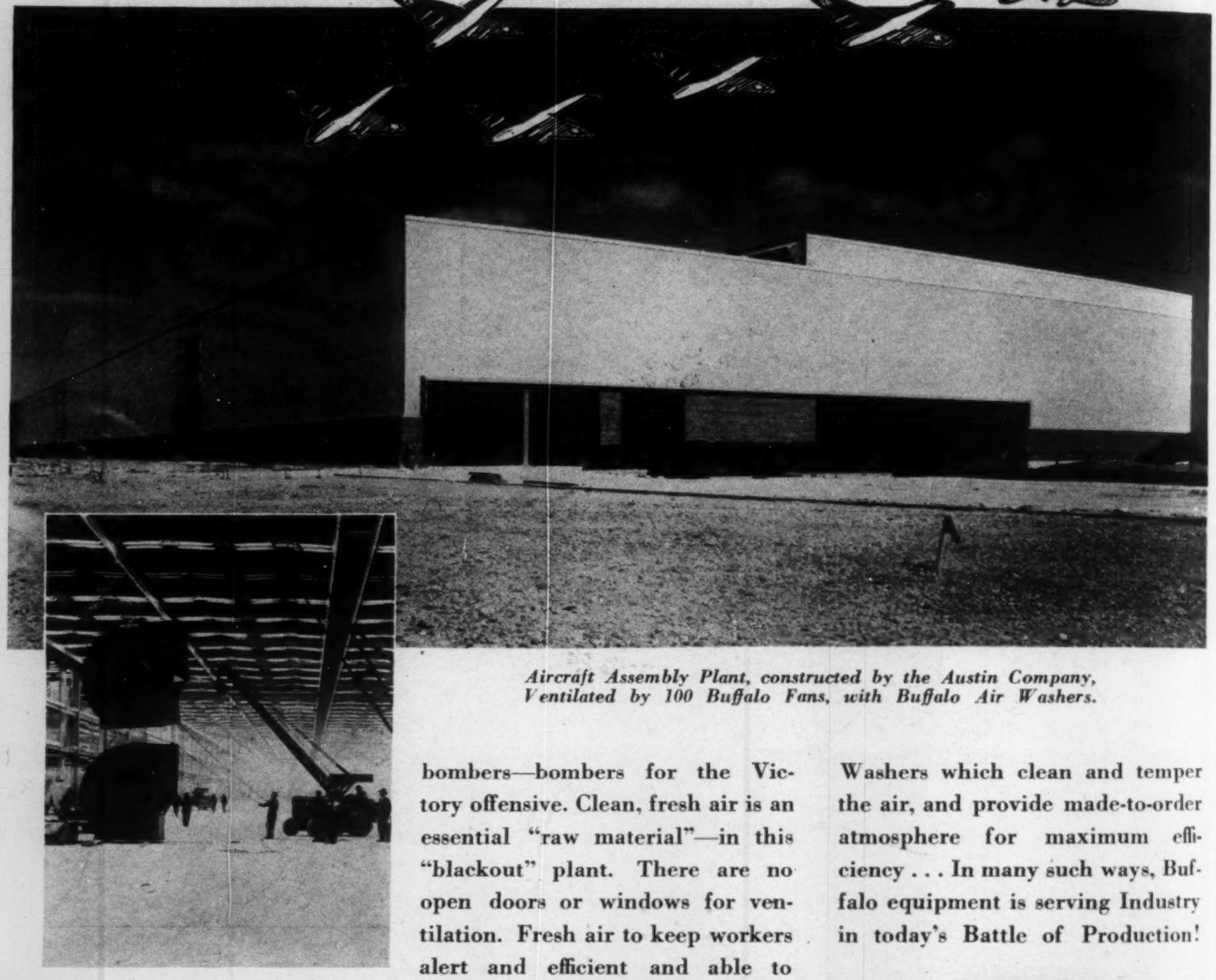
Name.................................. Title ....

Company ....

Address ....

City................................ State ....

BOMBERS BY THE ACRE



Aircraft Assembly Plant, constructed by the Austin Company, Ventilated by 100 Buffalo Fans, with Buffalo Air Washers.

● Over the expanse of floor space in this mammoth plant briskly roll the assembly lines of deadly bombers—bombers for the Victory offensive. Clean, fresh air is an essential "raw material"—in this "blackout" plant. There are no open doors or windows for ventilation. Fresh air to keep workers alert and efficient and able to carry on during every precious hour of the day is supplied by Buffalo Fans—a hundred husky Buffalo Fans, with Buffalo Air Washers which clean and temper the air, and provide made-to-order atmosphere for maximum efficiency . . . In many such ways, Buffalo equipment is serving Industry in today's Battle of Production!

★ ★ ★

FANS *and* AIR CONDITIONING EQUIPMENT

BUFFALO FORGE COMPANY

171 MORTIMER STREET BUFFALO, NEW YORK

Branch Engineering Offices in Principal Cities

CANADIAN BLOWER & FORGE CO., LTD., KITCHENER, ONT.

firing with undergrate fan. It is made in eight sizes from 750,000 to 4,000,000 Btu per hr output.

As is the case with other of the manufacturer's direct fired heaters, the unit is entirely self-contained, having its own combustion chamber and distributing warm air either directly from outlet vents into the area to be heated, or, when partitions or obstructions make it necessary, through a simple duct system.

The coal burning series follows the combustion plan previously used in the maker's oil and gas fired heaters. A corrugated combustion chamber with fins and deflectors makes possible heat transfer to a moving air stream at about the same rate per square foot of surface as is obtained in a boiler, it is said.

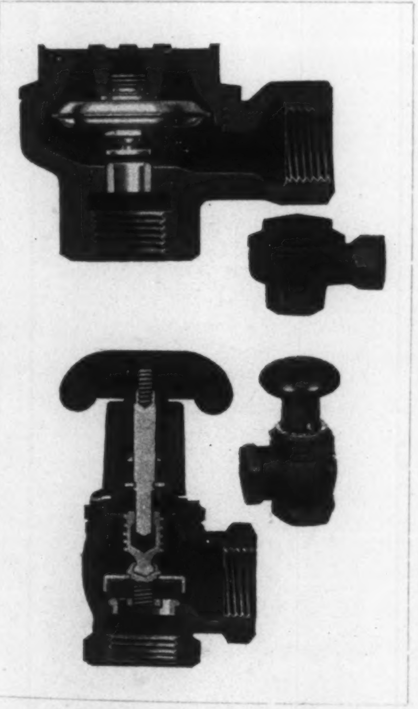
Furnace temperatures are kept down because the large portion of the heater surface about the refractory is in sight of the fire. Practically three-quarters of the heat recovered is by means of radiation into this "black surface" in the upper part of the combustion chamber. The bridgewall is also cooled by means of a duct through its center which conducts a flow of air induced by vanes in the air stream from one side of the heater through the bridgewall to the opposite side.

The unit may be installed during construction, used for temporary heat, and retained as a permanent system.—Dravo Corp., Neville Island, Pittsburgh, Pa.

Vapor and Vacuum Heating Specialties

No. 2290—A line of vapor and vacuum heating specialties, in which cast iron bodies replace brass as formerly used by the manufacturer, is announced as the "Victory line." The thermostatic radiator trap and packless radiator valve are illustrated.

The trap, available in ½ and ¾ in. sizes, angle body only, consists of two principal parts, a cast iron body with cuprous alloy valve seat, and a cast iron cover containing the fluid filled thermostatic disc. Connections are left hand tapped inlet and right hand outlet. Delivered painted gray enamel. The thermostatic elements are interchangeable in covers without gages. The cover and disc assemblies are interchangeable with former standard traps.



The valve is of the spring packed type, known to the trade as "packless." The body and bonnet are cast iron, the handle is of nonbreakable, heat resisting composition. The valve is quick opening, with less than one turn of the handle. It is made in angle pattern only, in

40,000 TODD UNITS

helping to cook Hitler's goose!

DEFEAT of the Axis begins in America's power plants, where fuel-energy is unleashed and put to work . . . is transformed into machines turning . . . planes flying . . . shells blasting the enemy's strongholds! All-out power production . . . top combustion efficiency . . . mean more tools for the job . . . speedier overthrow of Berlin, Rome and Tokio!

Todd Equipment, in power plants of every type, is taking today's three-shift load in its stride . . . setting the pace everywhere for minimum-maintenance and maximum-performance in the firing of liquid and gaseous fuels. Over 40,000 Todd units are now in service, in individually designed installations, backed by more than a quarter-century of combustion engineering experience. Todd technical service staffs in key cities, with parts and replacements always available, are helping industry to reach—and surpass—the power-quotas required by America-at-war.

TODD COMBUSTION EQUIPMENT, INC

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

(Division of Todd Shipyards Corporation)

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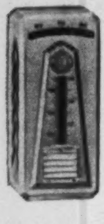
MERCOID CONTROLS

MEET YOUR CRITICAL WAR TIME REQUIREMENTS

FOR INDUSTRIAL OIL BURNERS * COAL

STOKERS * UNIT HEATERS * GAS BURNERS * REFRIGERATION,

AIR CONDITIONING AND VARIOUS INDUSTRIAL APPLICATIONS

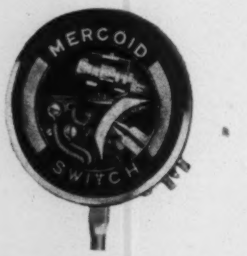


MERCOID SENSATHERM

A distinctive low voltage thermostat widely noted for its close room temperature control.

MERCOID VISAFLAME

A light-sensitive control system—a great improvement to safeguard oil fired equipment for heating plants, space heaters and various types of industrial ovens.

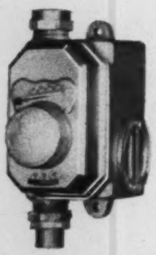


MERCOID PRESSURE CONTROL

This control is unsurpassed for reliable service. The outside adjustment has met with popular favor.

LIQUID LEVEL CONTROL

With explosion-proof housing. Recommended for use in hazardous locations.



EXPLOSION-PROOF THERMOSTAT

For room temperature control in hazardous locations. The electrically live parts are housed in explosion-proof chamber—assuring positive protection.

MERCURY SWITCHES
ASSURE PERFECT OPERATION
AND LONGER CONTROL LIFE

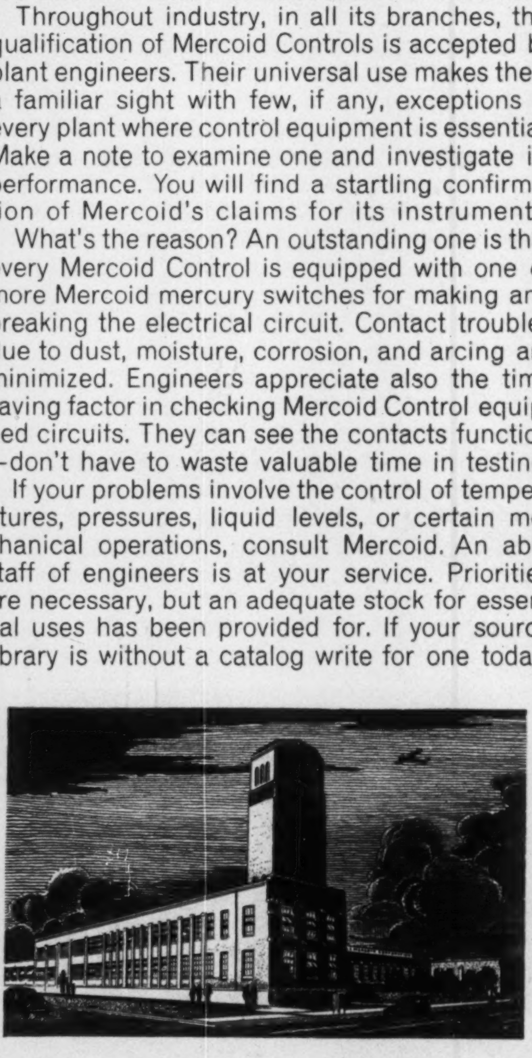
A MERCOID PRODUCT

The design, construction and operation of Mercoid Controls fit them for the exacting requirements of wartime emergencies, when service attention must be reduced to a minimum.

Throughout industry, in all its branches, this qualification of Mercoid Controls is accepted by plant engineers. Their universal use makes them a familiar sight with few, if any, exceptions in every plant where control equipment is essential. Make a note to examine one and investigate its performance. You will find a startling confirmation of Mercoid's claims for its instruments.

What's the reason? An outstanding one is that every Mercoid Control is equipped with one or more Mercoid mercury switches for making and breaking the electrical circuit. Contact troubles due to dust, moisture, corrosion, and arcing are minimized. Engineers appreciate also the time saving factor in checking Mercoid Control equipped circuits. They can see the contacts function—don't have to waste valuable time in testing.

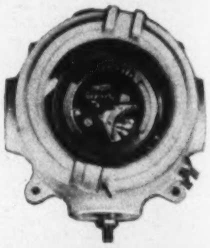
If your problems involve the control of temperatures, pressures, liquid levels, or certain mechanical operations, consult Mercoid. An able staff of engineers is at your service. Priorities are necessary, but an adequate stock for essential uses has been provided for. If your source library is without a catalog write for one today.



THE MERCOID CORPORATION
4231 Belmont Avenue • Chicago, Illinois

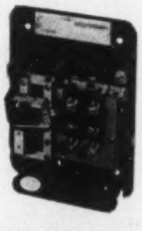
MERCOID NO. 855 THERMOSTAT

Operates directly on line voltage. Universally accepted by the trade for its dependable performance.



EXPLOSION-PROOF CASES

Available with any type of temperature or pressure control. Recommended for all hazardous locations.



TRANSFORMER-RELAY

Has low voltage pilot circuit and is especially suitable for applications where a quiet and dependable relay is essential.

REMOTE BULB TEMPERATURE CONTROL

With double outside adjustment feature. Available in various ranges for numerous types of industrial applications.

TYPE TV2 STOK-A-TIMER

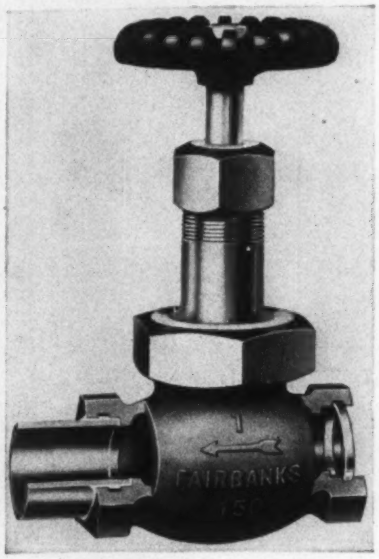
This stoker timer will function for years without service. No gears—no high speed operating parts—no lubrication required—built to endure.

¾ and 1 in. sizes. To meet the government's wartime specifications, it is tapped right hand inlet and left hand outlet. Delivered painted gray enamel.

Other specialties in the line are float and thermostatic traps, closed float traps, return traps, strainers, unit heaters and pumps.—C. A. Dunham Co., 450 E. Ohio St., Chicago, Ill.

Bronze Valves for Silver Brazing

No. 2291—A new line of "Faircoseal" bronze valves contain pre-inserted rings of "Sil-Fos" silver brazing alloy in the port openings, instead of threads. With this design, valve and pipe can be easily brazed together into a one piece piping assembly by the application of an oxyacetylene flame, the manufacturer points out. When valves are connected to brass, copper or copper nickel pipe, a "Silbraz" joint is formed. Such joints are designed to withstand tension, compression, torsion, vibration, and corrosion to the same degree as the pipe or tube with which they are used. They are silver brazed joints, not soldered joints.



It is claimed that these joints have high tensile strength and will not pull apart at any temperature to which the valve or pipe can be safely subjected.

These joints do not depend on wicking, solder or pipe dope to effect a water or gastight seal, as both pipe and valve are brazed together as one piece, it is stated.

With these bronze valves, copper, yellow or red brass, copper nickel and monel pipe can be used. The valves can be used with steam, oil, hot or cold water, compressed air, acid, "Freon," sulphur dioxide, etc.—Fairbanks Co., 396 Lafayette St., New York, N. Y.

Plastic Tubing Fittings

No. 2292—Fittings molded from "Saran," the new thermoplastic, are now available for tubing sizes ⅛ to ⅜ in. OD. By means of these fittings it is now possible to set up a complete chemically resistant piping system without the use of any metal.

These fittings have a high tensile and bursting strength, are non-corroding and non-aging and, being also nonconductors of electricity, are able to prevent the formation of galvanic couples, according to the announcement. —Acadia Synthetic Div. of the Western Felt Works, 4115 W. Ogden Ave., Chicago, Ill.

Recessed Air Diffuser

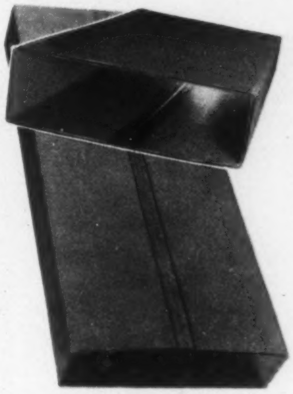
No. 2293—The recessed type "Venturi-Flo" is a spun steel overhead air diffuser with flow characteristics sim-

A·R·A SHEETS

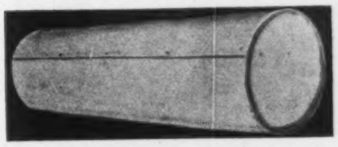
Are Now Available for

DUCT WORK

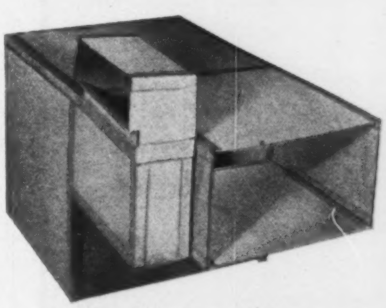
FITTINGS • CASINGS AND "PANNING" JOISTS



A.R.A. Sheets are designed and built to conserve metal . . . Rigid but not brittle A.R.A. Sheets can be easily made into ducts, as shown on the left . . . with the use of ordinary tools and a single seam of metal . . . or they can be rolled into round pipe and fastened with the metal seam.

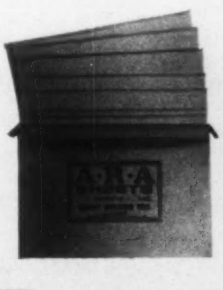


A.R.A. Sheets are tough yet flexible (mullen tested over 200 lbs. per sq. in.) . . . and being fireproofed and waterproofed their uses are many. They can be fabricated into fittings for warm air and air conditioning systems as well as casings of various kinds.



A.R.A. Sheets are light in weight, will not dry out, crack, crumble or chip, have a high insulating value (K.45 B.t.u.) . . . and good sound deadening properties. They are easy to handle, will bend without breaking and can be rolled, punched, scored and die cut, still retaining their rigidity and strength.

Also used for "Panning" joists for cold air returns.



A.R.A. Sheets are shipped in cartons. Each carton contains 20 sheets 33"x48" or 40 sheets of 16½"x48". A carton weighs about 100 lbs.

Write for Samples and Information

GRANT WILSON, INC. · CHICAGO
4101 W. TAYLOR STREET

THE CYLINDERS ARE COMING BACK
"FREON"

...AND KINETIC CAN AND WILL SUPPLY THE "FREON"

TO THOSE in the industry who are so wholeheartedly answering our call to return "Freon"* cylinders promptly, Kinetic Chemicals, Inc., wishes to extend its thanks and to give this reassuring statement of the availability of "Freon-12":

There is now *no* shortage of "Freon-12." As the situation stands today, there will be enough "Freon" available for the servicing of all refrigerating machinery in the United States and friendly foreign countries. In addition, there will be enough available for the initial charge in such refrigerating machinery as is permitted to be built under the limitation orders of the War Production Board.

This satisfactory supply situation has been brought about through the elimination of bottlenecks — making adequate amounts of the raw material available and raising our plant capacity 38% over that of last fall. As a result, during the months of March, April, May and June, a full allocation of "Freon" was made in the amounts requested by everyone. In addition, we have been able to build up a stock of "Freon-12" to take care of the peak demand during the summer months.

Of course, this does not mean that conservation of "Freon" refrigerants is any less necessary during the war months ahead than it has been in the critical period through which we have just passed. Allocations of raw materials to this industry are premised on proper and careful use of "Freon-12." We urge you to cooperate with the Refrigeration and Air Conditioning Industry's "Program for Victory"—to impress on every user the necessity for proper maintenance of equipment to conserve power, repair parts and refrigerants, and to return cylinders promptly.

With your full cooperation, we shall be able to continue to report: "There is no shortage of 'Freon-12.' Adequate supplies *are* available for servicing existing installations and for the initial charges for permissible new equipment."

KINETIC

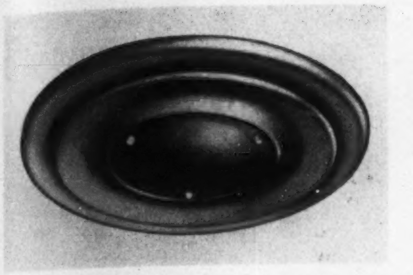
FREON

REG. U. S. PAT. OFF.

safe refrigerants

**"Freon" is Kinetic's registered trade-mark for its fluorine refrigerants*

KINETIC CHEMICALS, INC., TENTH & MARKET STREETS, WILMINGTON, DELAWARE

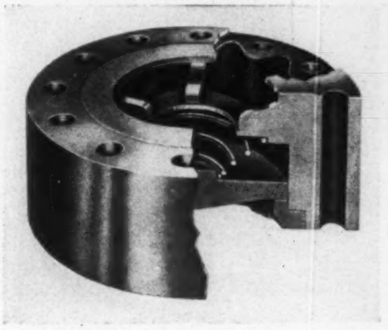


ilar to those of a venturi meter, the manufacturer states. The relationship between the neck area of the unit proper, and the venturi throat, is such as to create a slight back pressure in the neck at all times in order to insure uniform distribution around the periphery.

A wide range of sizes and special styles permits handling air volumes up to 15,000 cfm per unit.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Check Valves from 1 to 20 In.

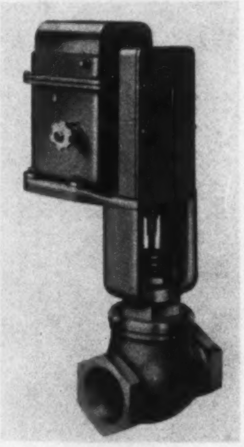
No. 2294—An improved line of check valves are furnished in a wide variety of metals and sizes. Designated as "Williams-Hager" flanged silent check valves, they are manufactured of bronze, cast iron, steel, stainless, and monel metal for pressures varying from 150 to 2500 psi. Sizes range from 1 to 20 in.



These valves are recommended by the maker for use in air conditioning systems, waterworks, oil refineries, chemical works, hydraulic services, boilerfeed, water supply and other nonreturn flow lines. In general they may be used in all pump lines handling water, oil, gas, acids, alkalies, and other fluids.—Williams Gauge Co., 1620 Pennsylvania Ave., N. S., Pittsburgh, Pa.

Valve for Close Regulation

No. 2295—The "Microvalve" illustrated here is used for the control of steam, water, oil or gas in air conditioning systems, dryers, and industrial process work where close regulation is required.

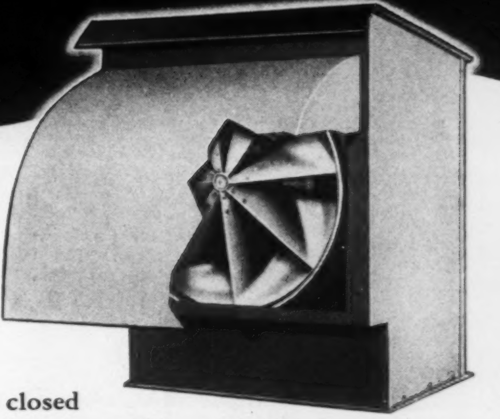


It is a motor operated valve with a proportioning type operator; the operator consists of a "Microtrol" with the addition of an eccentric cam that operates the valve plunger. Single seat V ported, double seat V ported, and double seat three way valve bodies are available. — Barber - Colman Co., 225 Loomis St., Rockford, Ill.

Wartime Unit Heaters

No. 2296—The "Victory" line of unit heaters with all-steel heating elements to replace copper and bronze

HOW TO SOLVE THE PROBLEM OF
BLACKOUT VENTILATION



(Right) *Ilg Power Roof Ventilator with special "Blackout" Hood, which can be quickly, easily fabricated on the job.*

BLACKED-OUT, closed windows *accentuate* the real need for positive, *adequate* ventilation! From coast to coast, "Blackout" Hoods on Ilg Power Roof Ventilators plus Hooded Fresh Air Inlet Louvers, are now blocking out light from plants, while "worn-out" air, odors, excessive heat, dust or harmful vapors are removed swiftly and quietly—regardless of weather conditions!

BLACKOUT
YOUR WINDOWS but not your VENTILATION
ILG
Vitalized Ventilation
AND AIR CONDITIONING
AIR CHANGE... NOT JUST AIR MOVEMENT!

NEW BULLETIN 304
Get Your Copy Today!

. . . gives you the complete story on "blackout" ventilation . . . shows a typical Ilg engineered installation . . . illustrates the design of "Blackout" Hoods and positioning of Fresh Air Inlets.

DIMENSION DRAWINGS—of "Blackout" Hoods and Fresh Air Inlets for the specific job you are figuring on will be furnished on request.

ILG ELECTRIC VENTILATING CO., 2841 N. CRAWFORD AVE., CHICAGO, ILL.
OFFICES IN 41 PRINCIPAL CITIES — CONSULT YOUR PHONE DIRECTORY

ILG
Vitalized Ventilation
AND AIR CONDITIONING
AIR CHANGE . . . NOT JUST AIR MOVEMENT!

WELDOLETS·
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THREDOLETS
. . . *Welded Outlets for Piping* . . .

How to Improve Flow Conditions in Piping Systems with Right-Angle Branch Pipe Outlets

ONLY with Bonney WeldOlets, ThredOlets or Socket-End WeldOlets is it possible to get the greatest degree of flow efficiency at 90° branch pipe take-offs.

Threaded tees, the accepted way of making 90° take-offs until the introduction of welded piping, provide flow conditions with such turbulence and friction caused by a sharp change of direction. However, installation is costly and unsatisfactory. Fig. 1 shows how the main pipe must be cut . . . the necessity for three threading operations (A) which cut away 40% of the pipe. In addition there is the strong possibility of leaks (B).

WELDOLET

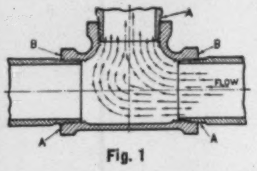


Fig. 1

Fig. 2 shows a pipe-to-pipe intersection weld which provides neither free flow nor strength at the junction (A). Sharp, right-angle turns (B) definitely restrict flow. Worse restrictions occur when the branch pipe extends into the main pipe (C). Other bad features are the large amount of weld metal required (D), the danger of icicles within the junction or of weld metal or scale passing through the system to clog valves and do other damage.

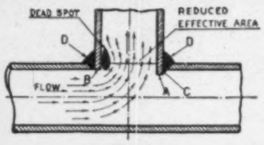
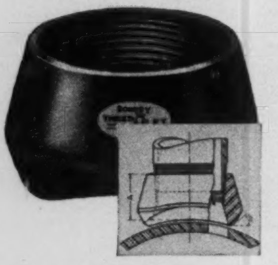


Fig. 2



THREDOLET

Bonney WeldOlets, ThredOlets or Socket-End WeldOlets, Fig. 3, because of their heavy, external rib and wide bases, compensate for loss of strength in the main pipe when the button is removed (A) and provide junctions of full pipe strength which are absolutely leakproof. Free, unrestricted flow (B) is provided by their wide, funnel-shaped intake aperture. They definitely eliminate threading and fitting of the main pipe and the sharp 90° turn found in pipe-to-pipe intersection welds.

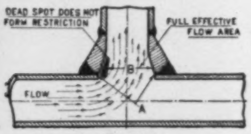
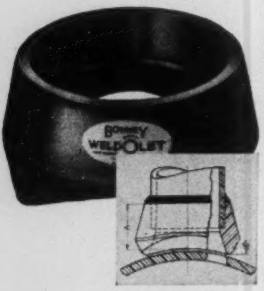


Fig. 3

Standard, stock fittings (outlets from ½" to 12") are drop forged steel and available for all standard pipe sizes. Or, on special order in sizes up to 24" x 24". They are suitable for every type of piping installation, and for all commonly used pressures and temperatures.



Socket-End WELDOLET

Your local distributor will be glad to tell you the full story of WeldOlets, ThredOlets and Socket-End WeldOlets—or write for Bulletin WT29—TODAY.

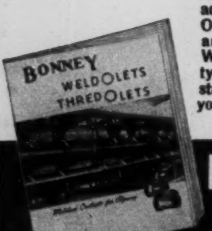
EASILY INSTALLED

Mark center lines and tack the fitting into place.

Then weld the fitting to the main pipe.

Remove the button, which will also permit inspection of the inside of joint.

Then attach the branch pipe.



Bulletin WT29—20 pages packed with information and data on advantages of WeldOlets, ThredOlets and Socket-End WeldOlets in all types of piping installations. Write for your copy NOW.

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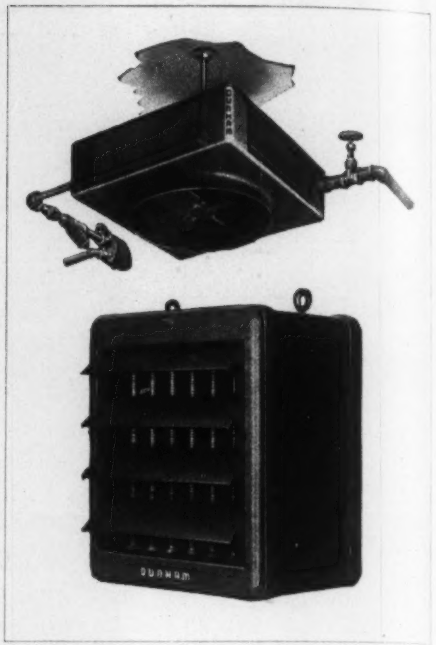


in order to conserve critical metals under WPB rulings, has been announced.

These units, similar to the former standard models, are available in a wide variety of types and sizes, including propeller fan types for both horizontal and vertical discharge in sizes ranging from 65 sq ft EDR to 2000, and centrifugal blower types in small cabinet models and large industrial types, sizes from 75 sq ft EDR to over 4000.

The heating elements consist of steel tubes welded to steel headers. The method of attaching fin and tube is such that each fin maintains mechanical pressure on the adjoining fin to provide a tight mechanical joint. The headers, tubes, and all parts which come in contact with steam and condensate are said to be approximately the same thickness as standard steel pipe.—C. A. Dunham Co., 450 E. Ohio St., Chicago, Ill.

Ductwork Conserves Metal

No. *2297**—"Formdux," an improved ductwork which—says the manufacturer—uses only 20 per cent of the metal usually required, has been announced.

The sheets are shipped flat and require minimum storage space. According to the manufacturer, they have high tensile strength, and as they are fireproof, may be used in forming plenum chambers. The sheets have a high insulating quality which conserves fuel, low resistance to flow of air, and can be put together with airtight connections by sheet metal workers.—Airtemp, Div. of Chrysler Corp., Leo St., Dayton, Ohio.

National Emergency Alloy Steels

No. *2298*—Joseph T. Ryerson & Son, Inc., has announced the addition of the new "NE" (national emergency) alloy steels to warehouse stocks. These are the new "lean" alloy steels established by the metallurgical staff of the War Production Board to help conserve nickel, chromium, vanadium, etc., for the duration. To make them quickly available, a representative stock of hot rolled rounds in sizes ranging from ½ to 7 in. in diameter and in six different analyses has been planned.

Heretofore, these new steels have not been available for experimentation and it has been difficult to secure even small lots necessary for determining the suitability of the steels for an application. Now, manufacturers can get small lots for treating and testing in specific applications. This method will assure proper selection of steels, which can then be ordered confidently in production quantities.—Joseph T. Ryerson & Son, Inc., P. O. Box 8000A, Chicago, Ill.

A.C Arc Welding Electrode

No. 2299—An all position, high quality alternating current electrode, "Type W-26," extends the advantages and convenience of high quality a-c welding to both vertical and overhead positions, says its manufacturer, who states that it complies with the requirements of the following specifications: AWS filler metal specification E6011; Navy Bureau of Ships specification 46E3, grade 3, class 1; and the ASME boiler code, paragraph U68.

By the use of this electrode, welding shops and fabricators, who have heretofore needed to supplement their a-c welders with standby d-c welders for high quality work in the vertical and overhead positions, will now be able to release these machines for fabrication work where d-c welding may be essential.

This electrode is available in $\frac{1}{8}$ in. and $\frac{5}{32}$ in. diameters; other sizes from $\frac{1}{16}$ in. to $\frac{1}{4}$ in. are expected to be available shortly.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Scale Prevention and Corrosion Control

No. 2300**—A new product, "Micromet," designed to prevent scale and control corrosion in air conditioning units and other equipment has been introduced.

It is a glassy sodium phosphate made to a closely controlled composition and carefully crushed and sized. When placed in cold water it dissolves at the rate of 25 per cent per month. The usual feed necessary to correct scale, corrosion and "red water" troubles is 1 lb to each 24,000 gal of water, says the manufacturer. In air conditioning units, it may be fed by means of a shallow screen basket, placed in the sump of the unit, or by a simple pot type feeder of standard galvanized or black iron pipe placed in the feedwater line.—Calgon, Inc., 323 Fourth Ave., Pittsburgh, Pa.

Substitute Material for Gaskets

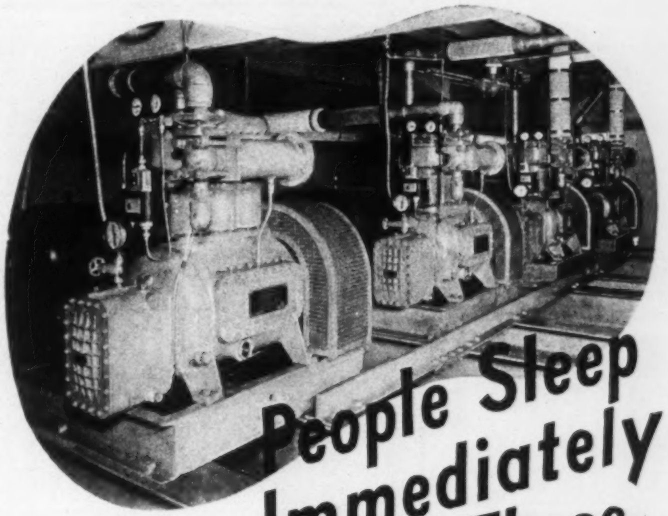
No. 2301—A new cellulose product known as "Onco V" was originally discovered during research on filter materials for gas masks. According to the manufacturers, it is felt that it will have many applications as a substitute or alternative material for leather and cork, one application being for gaskets.

The first commercial use of this new product has been in the shoe industry where it is being used as an insole fabric to replace the latex impregnated materials commonly used before the rubber restrictions.—Brown Co., 500 Fifth Ave., New York, N. Y.

Adhesive Nameplates

No. 2302—Due to the necessity for conservation of metal, many industries have found it necessary to use a substitute for name plates, metal tags, identification, patent number and instructions tags.

A new product has been developed under the trade name of "Kum-Kleen" which may be used as a substitute. This product adheres permanently to any smooth surface (including metals, glass, plastics, enamel, varnish and wood), is applied without moistening, and will adhere when exposed to high temperatures or changing climatic conditions, the maker says.—Avery Adhesives, 451 E. Third St., Los Angeles, Calif.


People Sleep Immediately Below These

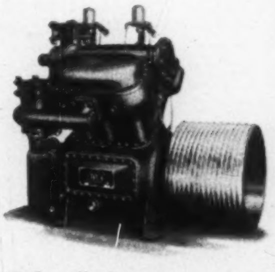
FRICK TRADE MARK

Refrigerating Machines

The Ansley Hotel, Atlanta, likes Frick Refrigeration.

The four compressors, installed on the top floor of the Ansley Hotel (Atlanta, Ga.) operate so smoothly and quietly that guests in the bedrooms right under them never know the machines are there!

The Rainbow Room, built on the former roof of the hotel, and measuring some 100 by 80 ft., is air conditioned to the entire satisfaction of the owners by these Frick "Eclipse" machines, installed a year ago.


"Eclipse" Compressors are built with 3, 4, or 6 cylinders. Ask for Bulletin 100.

Your cooling work can be handled most dependably with Frick Refrigeration. Get in touch with the nearest Frick Branch Office or Distributor.

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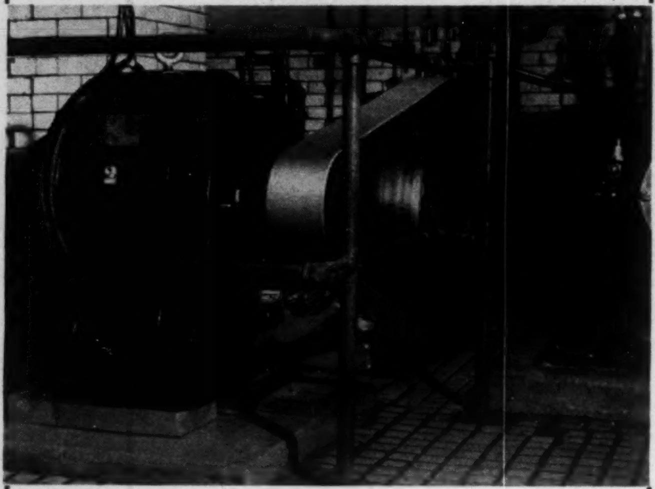
WAYNESBORO, PENNA. U.S.A.

DEPENDABLE EFFICIENT

Long lived, with little maintenance!



● The Tannate-Rockwood pivoted motor base drive outpulls and outlasts ordinary drives. It maintains uniform machine speed with infrequent attention.

If the load varies, the weight of the motor on the pivoted Rockwood base automatically adjusts belt tension. Maximum power is kept flowing smoothly, with less wear on belt and bearings. And, the Tannate belt always grips tightly, pulls steadily, resists stretch and slippage.

A Tannate-Rockwood drive may help solve a troublesome problem for you. Ask us about it.

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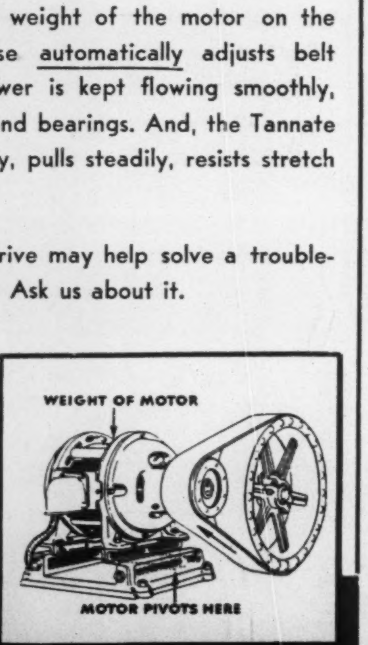

RHOADS

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SHORT CENTER DRIVE

"AN ARMY TRAVELS ON ITS STOMACH"

Preservation of food is as important as the supply of food itself, in order to keep our boys in good health and fighting spirit.

Whether they are stationed in Greenland's icy cold, in Ireland's dampness, in the sweltering blaze of the Pacific, or in the dry heat of the Libyan desert . . . their food and supplies must be protected under those difficult climatic conditions; and Marlo equipment is now doing that.

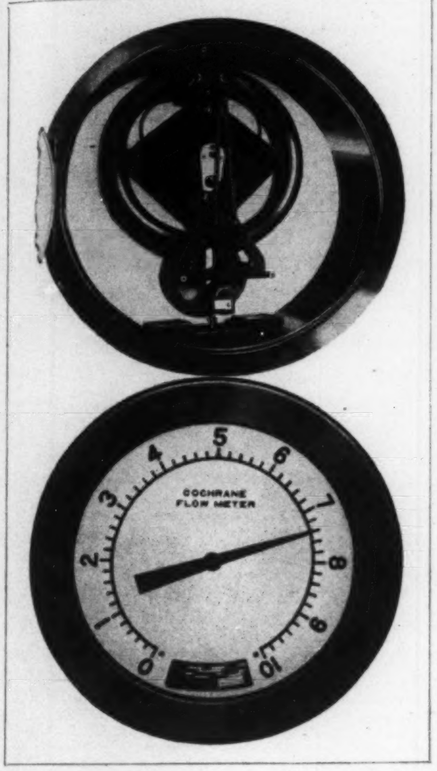
More than nine-tenths of our production is designed to protect food and supplies for the armed forces.

"MARLO MEANS HEAT TRANSFER EQUIPMENT"

MARLO
COIL COMPANY
ST. LOUIS, MISSOURI

High Pressure Flow Meter

No. 2303—In high pressure process operations in the neighborhood of 5000 psi, accuracy, freedom from maintenance, and safety are secured by a special adaptation of the ring balance (tilting U tube), according to an announcement. This meter has no float, stuffing box, or pressure tight bearing, being entirely closed and without internal working parts.



The mercury sealed manometer is a stainless steel ring 15 in. in diameter. The ring is balanced on knife edges at its geometric center. The partition at the top of the ring is formed of a solid stainless steel block suitably drilled for the pressure connections. Nickel tubing connects the top of the ring to the center of rotation where the free (inboard) ends of the twin 6 in. nickel torsion tubes are joined. The outboard ends of the torsion tubes are anchored and to these the pressure lines from the primary elements are connected. By this design the ring tilts 10 deg for the full differential range measurement which may be between 4 and 9 in. of mercury, depending upon the cam weight supplied.

The cam extracts the square root relationship so as to express the flow directly in uniform increments.

These meters are tested under 7500 psi and are in use in several plants for measurement of nitrogen, hydrogen and ammonia gases at pressures above 5000 psi.—Cochrane Corp., 3161 N. 17th St., Philadelphia, Pa.

Heat Transfer Equipment

No. 2304—"It has been brought to our attention (says a manufacturer), that our advertisement in the June issue of Heating, Piping & Air Conditioning may have created an erroneous impression.

"We have been and are manufacturing hot water storage heaters and all types of heat transfer equipment. Priority regulations, however, prevent us from shipping these units to many of our customers.

"If you enjoy sufficiently high priority ratings, we shall be glad to supply you with hot water storage heaters and heat transfer equipment promptly and courteously."—Patterson-Kelley Co., 109 Warren St., East Stroudsburg, Pa.

Miles of RU-BER-OID insulation in a city within a city

Miles of insulation efficiency because every job could be custom-built

This valuable Guide tells how and why

RUBEROID INSULATION GUIDE

Engineers: Ballinger & Co. Heating Contractor: Daniel J. Keating & Co. Builder: Wark & Co. Insulation Contractor: Achenbach & Butler, Inc., Philadelphia, Penna.

MATERIALS, MEN and METHODS . . .

All three contribute to insulation efficiency. The Ruberoid Co. offers you all three to custom-build each insulation job. Should any Ruberoid insulation product be temporarily withdrawn from the market, or priority orders make deliveries long delayed, Ruberoid will suggest another insulating material that may be substituted without the loss of efficiency.

Efficiency has to be the keynote in any Quartermaster Depot. In the Philadelphia Quartermaster Depot, a city within a city, insulation efficiency was assured. Each job was custom-built with RU-BER-OID Insulations. Because the Ruberoid line of insulations is complete the proper insulation could be chosen to meet each specific problem.

The picture above, shows some of the miles of pipe covering used on this project. Here, in the basement of the cafeteria, the steam lines required Imperial Pipe Covering—the cold and hot water lines Woolfelt. There are many RU-BER-OID Insulations in the power plant pictured below. Included are high temperature blocks and high temperature cements. In the pump room 85% Magnesia Pipe Covering was used.

You, too, should have at your fingertips the facts about the complete line of RU-BER-OID Insulations—how you can custom-build each job—reduce heat losses and the waste of fuel. We will be glad to give you these facts in a handy manual including charts and tables compressed for quick reading. The index tells you at a glance the temperatures you're interested in.

Send for your free copy of this valuable Guide. Address Dept. HP-7, The Ruberoid Co., 500 Fifth Avenue, New York, N. Y.

RU-BER-OID *Insulation*

For HEATING · COOLING · AIR CONDITIONING

All-Asbestos Duct

No. 2305—Over 2,000,000 lb of steel has been conserved on one air conditioning job alone by utilization of an all-asbestos, insulated duct. This saving has been effected in the new War Department building, according to W. L. Steffens, vice-president of the company manufacturing the product.

This product, it is said, has an advantage in combining both duct and insulation; because it is constructed entirely of asbestos it is a natural sound absorber and non-conductor of sound. This permits effective hushing of fan and equipment noises and eliminates "cracking" due to changes in air pressure or expansion strain.

Simple slip joint construction permits telescoping of the sections, simplifies handling and eliminates shop work, as fittings can be readily made on the job.—Philip Carey Mfg. Co., Wayne Ave., Lockland, Cincinnati, Ohio.

Registers and Grilles

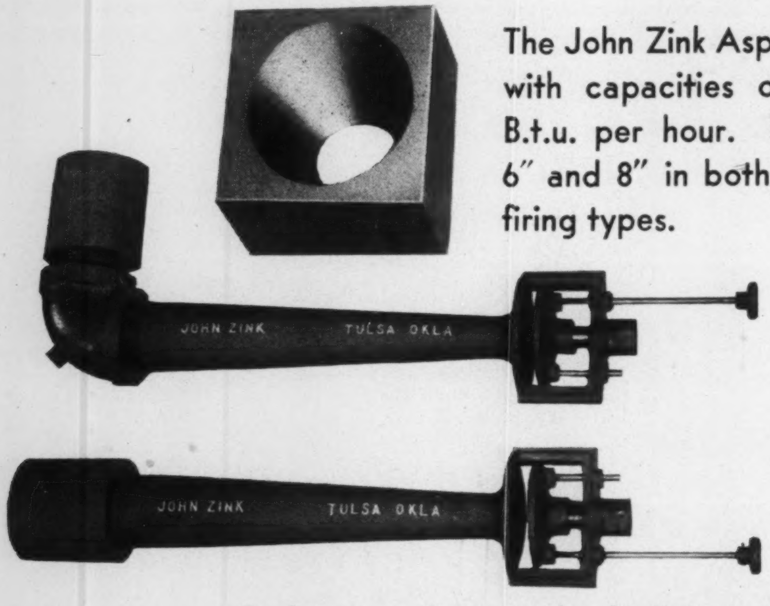
No. 2306*—New lines of registers and grilles are built both for general use and for marine applications.

The registers are of the double directional control type and are built to withstand heavy usage. A special spring construction prevents the blades from sticking and insures freedom from rattling at all times, according to the manufacturer. A spring holder adjusts itself automatically to changes in conditions and once the front blades have been set in position they can be made immovable, until a change is desired, by the tightening of a small set screw. The back blades are of a streamlined overlapping design and it is said that no air noise is produced even at high velocities. This is of importance in marine work where velocities of 1000 to 1500 fpm are usual.

The blades for the grilles, instead of being made from separate pieces, are produced by a continuous strip method. They are held in position in the frame by metal "teeth" solidly welded at the ends. According to the manufacturer, this construction insures a sturdy grille with freedom from rattling and other noise. It also enables mass production.

These grilles can be supplied with fixed blades and also with rear directional control or dampers of the same design as for the registers. The grilles are available in sizes from 6 in. x 8 in. to 30 in. x 12 in.—Davies Air Filter Corp., 118-120 E. 25th St., New York, N. Y.

John Zink Venturi Aspirating Gas Burners



The John Zink Aspirating Gas Burners are available with capacities of 200,000 B.t.u. to 15,000,000 B.t.u. per hour. Sizes 1¼", 1½", 2", 3", 4", 5", 6" and 8" in both VERTICAL and HORIZONTAL firing types.

For firing Boilers, Stills, Oil Heaters, Pipe Bending and Heating Furnaces, Kilns, Dryers, Special Heaters and Heaters where all air must be induced by burner. These burners require medium to high pressure gas for best operation and produce a clear blue flame pattern at high velocity.

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Useful Information

Heat Transfer and Insulation

Elements of Heat Transfer and Insulation, a new book by a pioneer research worker on heat transfer, Max Jakob, in collaboration with George A. Hawkins, well known for his research on steam, is among the first to present the subject in an organized and logical manner. The book is not intended to be an exhaustive treatise; instead, it aims to present the most important material on heat transfer in a text for the use of juniors and seniors in engineering courses.

Professors Jakob and Hawkins are to be congratulated. No one who studies their book can fail to obtain a clear idea of the fundamentals of heat transfer. Every engineer who has not had the advantage of a course in heat transfer in his school days—and this applies to the majority of engineers now practicing—can benefit from it, for it will give him a comprehensive idea of the entire field of heat transfer and a splendid background for further reading and study. Especially to be commended is the liberal use of illustrative examples and of simple charts for the more complicated mathematical functions.

The book consists of 15 chapters. The first is an introduction dealing with fundamentals. The next four deal with conductivity. In these chapters conductivity through insulating materials and through metal walls of various shapes is treated. In addition, the conduction of heat both for the steady and unsteady states is covered and formulas are presented for solving the various types of problems likely to be encountered.

Chapters 6 to 10 cover the industrially important topic of heat transfer between fluids. In addition, the best of the available empirical formulas for predicting heat transfer coefficients are presented, together with illustrative examples. Chapters 11 and 12 deal with radiation; and here, especially to be commended, is the chapter on the combined effects of conduction and radiation. Even engineers who are familiar with the separate topics are frequently unaware of how to handle combined effects. Chapter 14 deals with the effect of heat transfer in high temperature measurement, and the final chapter covers the theoretical and practical relationships between heat transfer and pressure drop.

Altogether this is a splendidly organized book—one which practicing engineers who desire a good background in heat transfer cannot afford to miss.

The publisher is John Wiley & Sons, Inc., 440 Fourth Ave., New York City. There are 169 + xvi pp., 5¾ in. by 9 in., and the price is $2.50.

Inspection of Welding

The American Welding Society has recently approved and published a committee report on Recommended Practices for Inspection of Fusion Welding. The result of two years of work by the committee, it represents a comprehensive treatment of the many factors involved in the inspection of welds made by the arc and oxy-acetylene processes.

The subjects covered include qualifications of welding

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Designed as a safeguard to life and property, White-Rodgers Explosion-Proof Thermostats are now available to cover all types of heating, air conditioning and refrigerating applications where hazardous conditions exist.

Both self-contained and remote-bulb controls are offered in standard ranges with external knob or tamper-proof internal adjustment.

Especially recommended for use in oil refineries, munitions plants, cleaning plants and similar locations where explosive fumes or dusts are present.

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inspectors; duties of inspectors; inspection and testing of welded structures; inspection during construction; shop and field inspections; examination of welds; radiographic inspection, hydrostatic testing and magnetic powder inspection.

A considerable part of the report deals with the welding characteristics of both ferrous and nonferrous metals. These sections describe the principal types of defects that may be encountered, indicate their usual causes, and state how they may be detected and remedied. While most of the report deals with the inspection of welds in ferrous material, there is a considerable discussion of the nonferrous metals, including copper and copper alloys, aluminum and aluminum alloys, and nickel and nickel alloys.

This report is published by the American Welding Society, 33 W. 39th St., New York, N. Y., in the form of a 23 p. bulletin with a heavy paper cover. It is available from the AWS at 40c per single copy, with discounts for quantities.

Handbook of Chemistry and Physics

In keeping with its policy of annual revision, the editorial board of the Handbook of Chemistry and Physics offers its 25th edition. The new information includes 15 pp. of tables of natural secants and cosecants, and conversion tables of pressure in inches or centimeters of mercury to millibars (newly standardized by the U. S. Weather Bureau).

Complete revision and enlargement has been made in the section dealing with properties of amino acids. In accord with a recognized need for the standardization of symbols used in mathematics and sciences, the previous collection of abbreviations and symbols contained in the handbook has been completely revised. The section on properties of commercial plastics has been maintained up-to-date to keep pace with developments in this rapidly growing and vital industry. Other revisions have been made in the section on vitamins, the table of isotopes, and the data on photographic plate and film speeds.

In addition to the above-mentioned changes, the 25th edition contains numerous miscellaneous additions and revisions which enhance its value to the scientific worker in all fields of research where up-to-date physical and chemical data must be readily available.

Comprising 2521 pp., price of this handbook is $3.50. The publisher is the Chemical Rubber Publishing Co., 2310 Superior Ave., N.E., Cleveland.

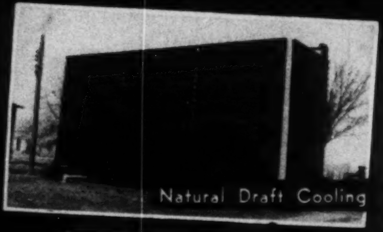
Principles of Economical Heating

One of the most valuable booklets the building engineer or manager has available is Principles of Economical Heating, issued jointly by the National Association of Building Owners and Managers and the National District Heating Association. First published in 1926, it has been reviewed and rewritten in 1933, 1937, and now in 1942.

Comprising fifty-three 6 by 9 in. pp., it includes general rules for economical heating, and sections on heat losses from buildings, determining the quantity of heat required in each building, temperature or heat control.

There's a BINKS cooling tower for every air-conditioning job

Induced Draft Cooling



Rotojet Spray Nozzles

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Outdoor Installations

BINKS cooling towers are designed to cut down water bills and reduce operating costs of modern air conditioning equipment. Each tower is tailor made for the particular job in hand. The towers are light in weight, adaptable to small areas and quiet in operation. BINKS ROTOJET spray nozzles break the water into an exceptionally fine mist for maximum cooling. Drift moisture is reduced to a negligible factor. In BINKS cooling towers both the first cost and operating costs are low. BINKS cooling towers are made in all sizes and types—forced draft or natural draft—for use indoors or outdoors.

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FIGURE YOUR AIR FILTER COST *by the year*

. . . not by the unit

Years of long life without need of replacements . . . that's the secret of the economy of AIR-MAZE permanent washable air filters. Even though they cost a bit more *per unit* than conventional "throwaway" filter panels the difference in cost is usually made up in a year or less.

After that they still have a life expectancy of 10 to 15 years . . . all pure velvet on the cost side, except for the minor expense of occasional cleaning. For AIR-MAZE filter panels can be cleaned *again and again* to make them like new with all their original performance characteristics.

Add to this the advantage of their superior efficiency . . . *better than 99% by actual test* (practical dust) . . . and you have the important reason for the growing popularity of AIR-MAZE panels for every air filter need. *Approved by the Underwriters' Laboratories.*

Write for interesting data on the economy of AIR-MAZE air filter panels.

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5200 HARVARD AVE. CLEVELAND, OHIO

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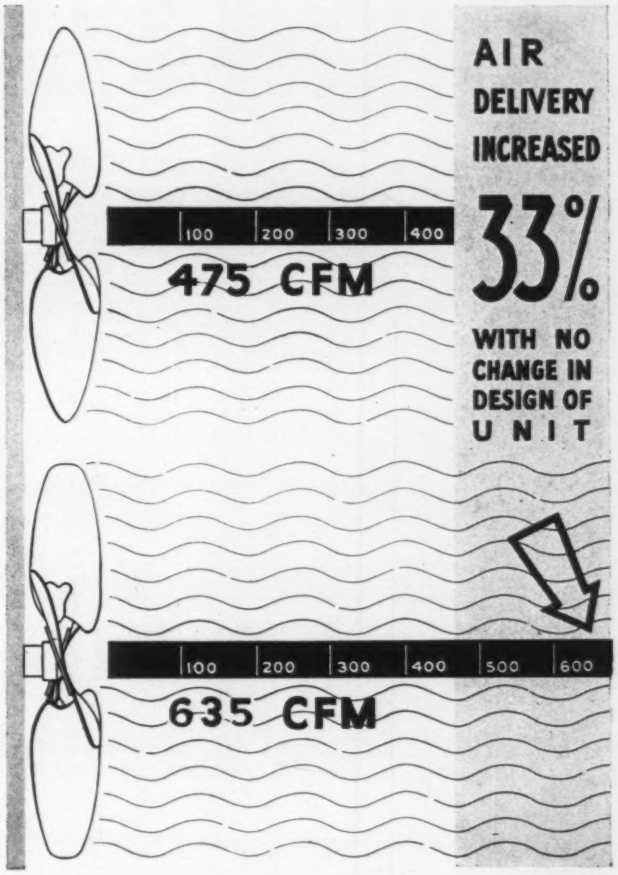
DEPENDABLE AIR FILTERS FOR EVERY APPLICATION



A UNIT heater manufacturer found it necessary to increase the air flow through one of the models from 475 CFM to 635 CFM, without changing the design of the unit.

Torrington engineers, on finding that steam coils and direction vanes were causing back pressures which cut down air delivery, recommended a pressure-type fan in place of the free-air model originally selected. They also suggested the use of a slightly larger blade, since they found that the original fan orifice would accommodate the larger size.

These recommendations, together with a change in pitch, resulted in the desired air delivery of 635 CFM —an increase of over 33%.

Consultation with Torrington engineers on fan and blower wheel applications is often helpful in getting maximum air deliveries and highest efficiencies.

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MANUFACTURERS OF AIRISTOCRAT QUIET PROPELLER FAN BLADES AND AIROTOR BLOWER WHEELS distribution in steam heating systems, methods of heat regulation, temperature control equipment, zone heating, additional methods of making savings in heating systems, common faults and methods of correction, and domestic hot water.

Single copies cost 25c plus postage. Address of the NABOM is 134 S. LaSalle St., Chicago. Headquarters office of the NDHA is at 827 N. Euclid Ave., Pittsburgh.

How to Write Good Letters

Let's Write Good Letters, by Sherman Perry, was prepared to help members of the "Armco" organization write better business letters—letters that are clear, concise, tactful, and effective. It is a volume which is helpful to executive and stenographer, transcriber and correspondent.

Realizing that many of its customers and friends will want copies of this book for their own organizations, The American Rolling Mill Co., 703 Curtis St., Middletown, Ohio, offers them at the nominal charge of $1.00 per copy, plus sales tax of 3 per cent in Ohio. The cost should quickly be repaid in most offices by the savings in time and typing charges which will result from following its many practical suggestions.

Field Inspectors' Check List for Building Construction

The National Bureau of Standards issued last month a Field Inspectors' Check List for Building Construction. Identified as Building Materials and Structures Report BMS81, it is for sale by the Superintendent of Documents, Washington, D. C., for 20c. It comprises 68 pp., 5 by 7½ in. in size, with a durable cover.

The list is not a specification outline, but is intended to be a helpful daily reminder to the general field inspector. In arrangement it follows normal construction procedures and interlocking operations in regular order rather than by individual trades.

Sections on thermal insulation, sheet metal work, heating, air conditioning, and electrical work are included.

Sheet Metal Pattern Drafting

In planning his new book on Sheet Metal Pattern Drafting, the author (Frank J. O'Rourke, instructor in sheet metal pattern drafting, Massachusetts university extension division) has emphasized the fundamentals which should be understood by every sheet metal worker. All kinds of patterns are made by the same general methods, whether they are needed for the manufacture of airplanes, steam boilers, tanks for water towers, automobile bodies, or air conditioning ducts.

Chapters are included on elbows, T pipe joints, cornices, radial line developments, classification of intersections, intersections of frustums of cones with cylinders, development of scaline cones, triangulation methods, methods of design, horizontal and clustered Y branches, parallel line methods, designing transitional elbows, airplane sheet metal drafting, skylights, and definitions and construction methods.

The publisher is McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. There are 189 + vii pp., 6 in. by 9 in. size, and the price is $2.00.

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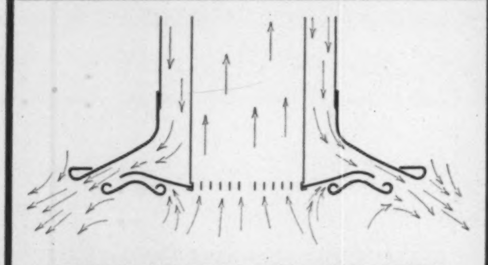

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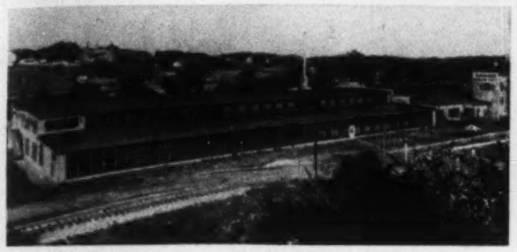

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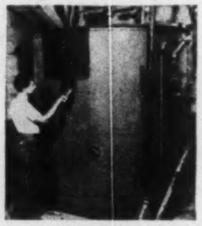

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No. 4211—4 p. bulletin listing the things the manufacturer has done for better lubrication and explaining the specific applications of the various products and how they are assisting in war production.—E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

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No. 4212—220 p. looseleaf, two volume set of maintenance rules and suggestions for men concerned with care of electrical apparatus in industry. The first volume covers inspection of electrical apparatus, insulation materials and applications; cleaning, drying and testing of insulation; commutator maintenance; and starting and regulating motors. Volume two is devoted to contactor maintenance, inspection of transformers and transformer connections.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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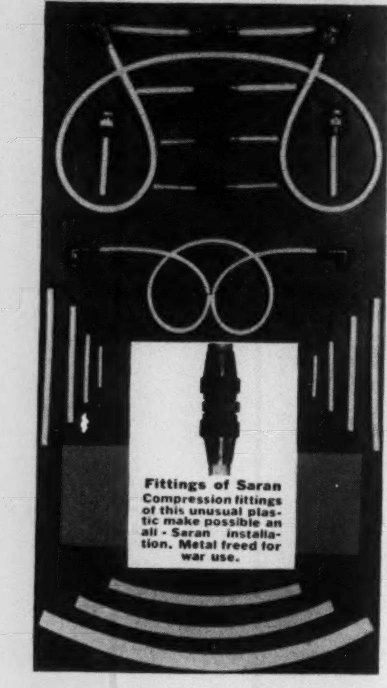

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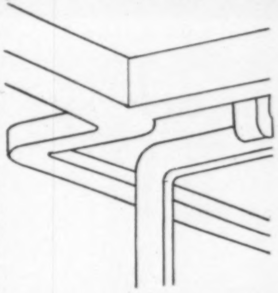

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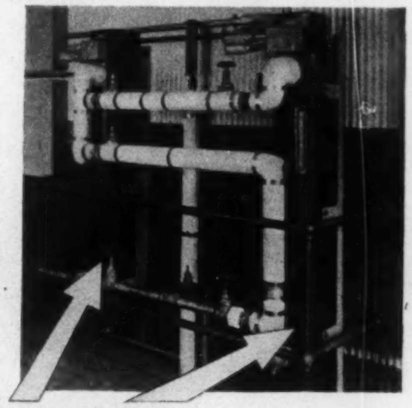

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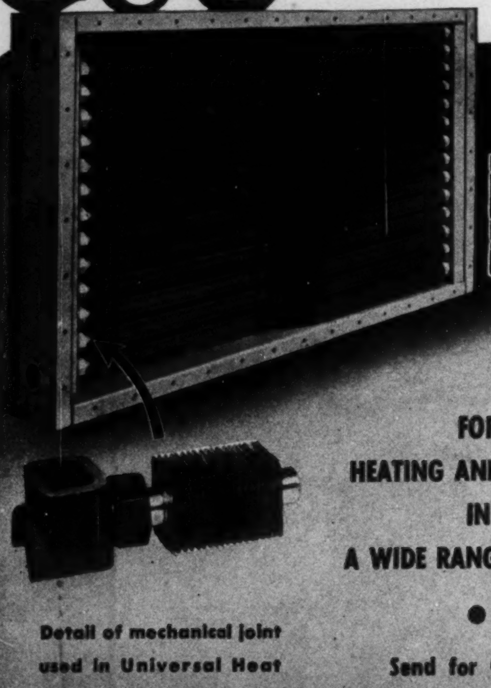

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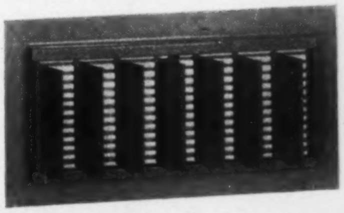

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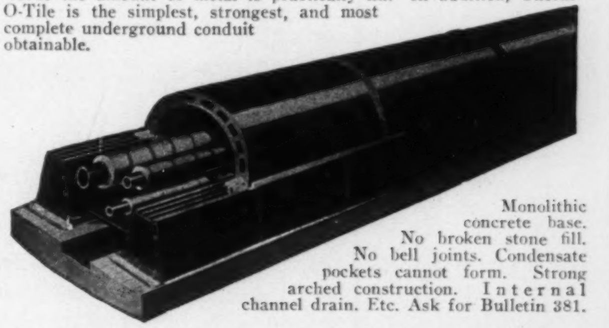

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No. 4227—Leaflet illustrating various methods employed by users of welding positioners to maneuver work into position for downhand welding and thereby increase production. Load capacities of the manufacturer's positioners are tabulated.—Ransome Concrete Machinery Co., Dunellen, N. J.

Wire Screen and Wire Cloth

No. 4228—116 p. handbook of information on woven wire screen and wire cloth products, including a glossary of terms; instructions on how to compute mesh, space and open area; illustrations of weaves; a section on selecting, ordering and testing; and with a wide variety of technical and other data.—Newark Wire Cloth Co., 351 Verona Ave., Newark, N. J.

Coming Events

Welding in War Production

American Welding Society: Annual meeting, October 12-16, Hotel Cleveland, Cleveland, Ohio, in conjunction with National Metal Exposition to be held in Cleveland Public Auditorium the same week. Theme of the meeting will be welding in war production, and technical sessions will include welding of aircraft, ships, tanks, and ordnance materiel; training welding operators and qualification; localized heat treatment; residual stresses and their relief; weldability of steel; gas cutting; resistance welding fundamentals; brazing and soldering; structural design; and non-destructive tests and inspection. Headquarters office of the AWS is at 33 W. 39th St., New York, N. Y.

THE EDITOR'S PAGES

SCRAP WILL HELP WIN THE SCRAP!

Formation of the American Industries Salvage Committee, representing groups of leading industrial concerns who are working with the conservation division of the War Production Board to help speed the collection of vital scrap materials, has been announced by Robert W. Wolcott, chairman of the group and president of Lukens Steel Co. Other members of the administrative committee directing the nationwide $2,000,000 campaign are Charles R. Hook, president of the American Rolling Mill Co., vice chairman; R. S. Wilson, representing Rubber Manufacturers Association; and O. E. Mount, representing Steel Founders' Society of America.

The work of the committee, backing up a broad advertising program, will be two-fold: (1) to reach every manufacturing and business firm in the nation to impress upon them the absolute necessity of getting their scrap on the way to the production line; and (2) to get business men cooperating with the local salvage committees of WPB already set up in 12,000 communities.

The activities of the committee will be closely coordinated with the present intensified scrap collection drive of the WPB, according to Mr. Wolcott. In this connection, the committee is underwriting the cost of an extensive national advertising campaign approved by the War Production Board, with a number of major industries underwriting the costs.

The advertising being carried on in newspapers, magazines, farm, and business papers and on the air, focuses the spotlight of public attention upon the need for iron and steel scrap, nonferrous metals, rags, burlap, rubber, tin cans (in some localities), and waste cooking fats.

The great task faced by American industry in meeting the expanding war production program, Mr. Wolcott said, makes it necessary for each company to intensify its scrap collection efforts.

"Production of war equipment," Mr. Wolcott said, "is limited by the amount of raw materials which are available. Scrap is an important part of the raw material supply. Industry must therefore do its utmost to increase its collection of scrap. We believe the efforts of the WPB in organizing and carrying out scrap collections have thus far produced excellent results. But the increasing demands of war call for still more scrap materials. The intensified campaign of the WPB deserves the whole-hearted support of every industrial company.

"Our committee, through the leaders which it is appointing in each trade, intends to obtain assistance for the WPB's drive in as many companies as we can reach. We hope to release for war use unusual sources of scrap which may have been largely untapped, such as obsolescent machinery, unused dies and jigs, and other types of idle plant equipment. By carrying out this campaign on an industry-by-industry and company-by-company basis, we feel that we can gear the effort to the individual trade's scrap possibilities."

TECHNICAL CHANGE IN LIMITATION ORDER L-38

A technical change in general limitation order L-38, which restricts production and sale of commercial refrigeration and air conditioning equipment, was made last month to assure more efficient administration of the order. The original order placed restrictions on sales and deliveries of new refrigerating and air conditioning equipment by producers, dealers, or other authorized channels of distribution. It did not define the term "other authorized channels of distribution."

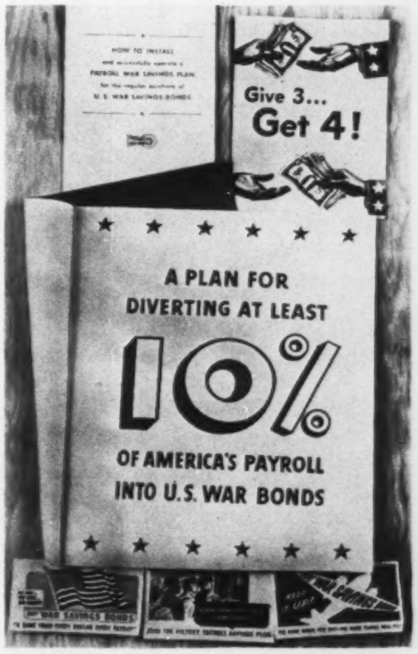
Under amendment No. 3, the term is defined to mean any person, including a factory branch or subsidiary of a producer, engaged in selling new refrigerating and air conditioning equipment to dealers for resale. A factory branch or subsidiary is included only if it is customarily billed by a producer in the same manner as are independent distributors, and if it was performing the functions of a distributor as of May 15.

TREASURY OFFERS MATERIAL TO PROMOTE BOND PURCHASES

Following a broad program to put the power of an organized promotional campaign behind the payroll savings plan, the United States Treasury Department has made available to nearly every business firm in the country a complete set of promotional material. It is designed to help business firms achieve more quickly the goal of at least 10 per cent of payroll invested in war savings bonds.

Nearly 100,000 of the nation's business firms have already installed, and are operating under, this plan which permits systematic purchases of war bonds by employees through voluntary allotments from each worker's pay envelope. In most cases the management of the company absorbs the entire cost of administration and bookkeeping—and the plan is so simple in its operation that this expense is normally quite modest.

Experience has proved that the payroll savings plan is most effective when stimulated by a well planned, fast-moving program to explain the operations and benefits of the plan and see that it is properly sold to each employee.



THE EDITOR'S PAGES

Continued

RATINGS FOR EMERGENCY REPAIRS EXTENDED

High preference ratings for deliveries of materials needed for emergency repairs to commercial air conditioning and refrigeration equipment have been extended until September 30 under the terms of amendment No. 1 to preference rating order P-126. The amendment is retroactive to June 30, when the original ratings would have expired.

Order P-126 assigns ratings ranging from A-1-a to A-8 for various types of emergency repair service undertaken by designated emergency service agencies. It also permits suppliers of these agencies to use the ratings.

The amendment provides that suppliers may extend the ratings subject to the conditions of priorities regulation No. 3, as amended. The amendment also makes certain technical changes in the original order, the effect of which is to write into the body of the order the restrictions on application of the ratings by emergency service agencies which formerly were a part of the endorsement that these agencies were required to attach to their purchase orders.

WAMPLER BECOMES CARRIER PRESIDENT

Cloud Wampler, executive vice-president of Carrier Corp., has been elected president, succeeding the late J. Irvine Lyle. Edward T. Murphy, senior vice-president of the corporation and one of its founders, has been elected a member of the board.

DIRECTS AIR CONDITIONING VICTORY PROGRAM

John K. Knighton, 119 N. Morton Ave., Evansville, Ind., has been appointed director of the wartime "victory program" of the refrigeration and air conditioning industry, it was announced by Dr. William R. Hainsworth, chairman of the group and president of the American Society of Refrigerating Engineers. Mr. Knighton is manager of the air conditioning division of Servel, Inc.

The objective of the program, which is sponsored by several associations, is for the united refrigeration and air conditioning industry to aid the government and the nation in every way possible to help win the war. The program stresses particularly conservation.

MOSHER, McINTIRE HEAD U. S. RADIATOR

William E. Mosher has been elected president of the United States Radiator Corp. to succeed the late Elwood S. White. James F. McIntire was elected first vice-president, and also succeeds Mr. White as president of the Pacific Steel Boiler Corp.

ESSENTIAL WAR OCCUPATIONS IN WHICH THERE IS SHORTAGE

Paul V. McNutt, chairman of the War Manpower Commission, made public last month a list of 138 occupations essential to war production in which there is a national shortage of labor. The list was compiled by the United States Employment Service and is based on the hiring schedules of approximately 11,000 major war industry establishments through August, 1942, in relation to the current reserve of workers.

Among the occupations included on the list are: acetylene burner operator; asbestos worker, general; boiler maker; boiler maker helper, assembly and erection; boiler shop mechanic; fit up man (boiler making); layout man (boiler making); oxyacetylene cutting machine operator; pipe fitter; sheet metal worker helper; welder, arc; welder, butt; and welder, flash.

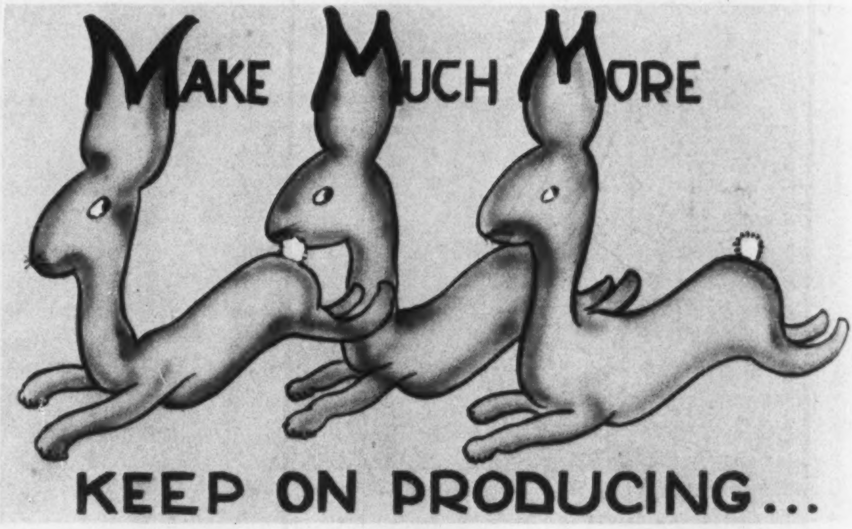
SHIPLEY APPOINTED TO SMALL WAR PLANTS CORP.

William S. Shipley, chairman of the board of the York Ice Machinery Corp., has been appointed director and vice-chairman of the War Production Board's Small War Plants Corp. The appointment, which was announced recently by Donald M. Nelson, WPB chief, recognizes Mr. Shipley's ability as author and prime mover of the York plan for bringing small plants into war production.

PLANT PLAYS HOST IN PRODUCTION RALLY

John J. Nesbitt, Inc., recently held a production rally of all employees at the plant to mark the occasion of converting a major portion of production facilities to direct war work. After an inspection of the plant by Army officials, the first of a new war product off the production line was presented by Albert J. Nesbitt, president and general manager of the company, to Lieutenant H. C. Troth.

A war production drive poster suggested and executed by two workers at a Manning, Maxwell & Moore, Inc. plant cleverly combines the company's production drive slogan and also introduces a humorous note. These posters are being used to stimulate increased production at three of the company's plants

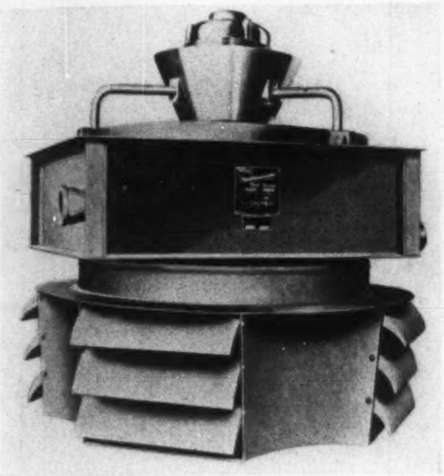


Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1942, HEATING, PIPING & AIR CONDITIONING *and thus keep your records of sources of supply up to date throughout the year...Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.*

Variable Discharge Unit Heater

No. 2307—An addition to a line of revolving unit heaters has a variable discharge. Provision for adjusting the amount of heated air discharged from any side of the heater is incorporated in the outlet, thus making possible the heating of a long narrow room or building with one revolving unit heater, the air streams being reduced and extended as the outlets cover the sides and the ends respectively.



The discharge from the multiple outlets is particularly effective in buildings or rooms with low ceilings, according to the manufacturer. The additional number of outlets breaks up the discharge into slower but more closely spaced streams of heated air which circulate around obstacles and reach cold corners, maintaining a uniform temperature and gentle movement of air throughout the entire building or room, it is stated.—L. J. Wing Mfg. Co., 14th St. & 7th Ave., New York, N. Y.

Safety Pressure Controller

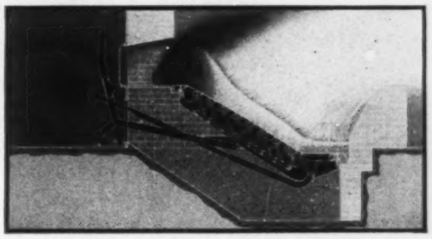
No. 2308—A safety device for manufacturing plants, especially those situated in areas in which bombing is apt to occur, has been developed.

Water pressure must be kept above certain limits in order not to become a hazard. Most manufacturing plants use water for cooling purposes, where a drop in pressure will cause damage unless the operator is warned immediately. War production plants are especially liable to two possible causes of pressure drop, aerial bombs and saboteurs.

The safety device consists of a pressure controller which will sound an alarm bell on pressure drop. This bell may be located any place in the plant most convenient for the person responsible.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., South, Minneapolis, Minn.

Hand Operated Stokers

No. 2309 — A complete line of "self-cleaning" hand operated stokers for changing over boiler installations formerly dependent on fuel oil, or on fuels threatened with scarcity at the present time, has been introduced. These stokers employ the "Cokal" firing principle—a coking method which produces smokeless and efficient combustion with inexpensive sizes and grades of bituminous coal, according to the announcement.

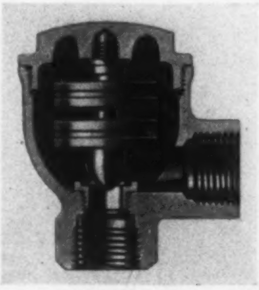


The coal is placed on the front of the stoker and is then distributed mechanically. One lever "does it all," advancing the fuel towards the dump plate, where the ashes can be dropped as they accumulate.

The stokers are designed for operation with natural draft and require no steam or electric power. Sizes range from 100 to 4000 lb per hr of coal. — American Coal Burner Co., 155 E. Superior St., Chicago, Ill.

Cast Iron Radiator Traps

No. 2310—The new "V . . . —" series of cast iron traps has been developed to comply with WPB requirements and to maintain the efficiency of the manufacturer's design standards. The "Type 17-D" radiator trap is illustrated. The body and cap are of cast gray iron. The inlet connection is ½ in. left hand thread, with right hand thread on special order only; nominal capacity is 200 sq ft of direct radiation.



For Your Convenience

[8-42]

HEATING, PIPING & AIR CONDITIONING,
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature." (*Circle each number in which you are interested*):

2307 2308 2309 2310 2311 2312 2313
4229 4230 4231 4232 4233 4234 4235 4236 4237 4238
4239 4240 4241 4242 4243 4244 4245 4246 4247 4248
4249

Name.............................. Title ....

Company ....

Address ....

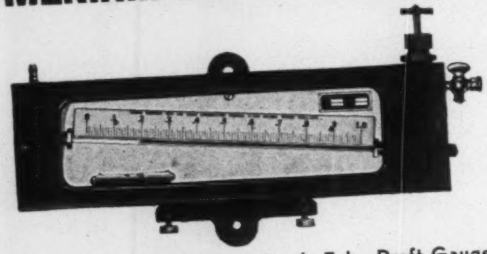
City.............................. State ....

"COME, TAKE YOUR FILTERS OUT —THEY'RE *NO* GOOD!"

★ How often filters are blamed for a faulty condition when in reality, the filters are perfectly all right. All they need is a good cleaning.

By the use of Meriam Draft Gauges you can quickly measure the pressure drop—and tell in an instant when the filters need cleaning. A small investment for these instruments will maintain high efficiency of filter operation.

MERIAM DRAFT GAUGES



Meriam GP Single Tube Draft Gauge

All Meriam Type GP Draft Gauges are direct reading instruments, built with inclined tubes to give increased scale length and permit accurate readings of fractional inches of water. The housings are furnished in dull black crackle and are provided with brackets for wall mounting. The lower bracket is provided with two adjusting screws to bring the gauge into level position after mounting, and a plunger unit in the gauge well adjusts the gauge fluid to zero position on the scale. Each gauge is individually calibrated insuring extremely accurate operation. Bulletin No. 4 giving complete details sent on request.

THE MERIAM CO.
CLEVELAND, OHIO

Manometers, Meters, and Gauges for the accurate measurement of Pressures, Vacuums and Flows of Liquids and Gases.

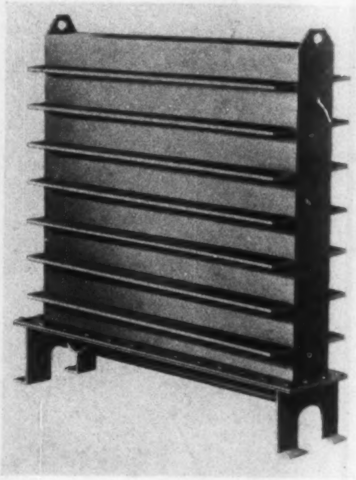
The thermostatic element is composed of four diaphragms of "Adnic," a special non-corrosive alloy. The valve pin is of special nickel silver alloy, bronze or brass. The whole thermostat and pin assembly may be interchanged in all bodies.

The valve seat is renewable.—Hoffman Specialty Co., Inc., 1001 York St., Indianapolis, Ind.

Cooling and Heating Aircraft Engine Test Oil

No. 2311—To test aircraft engines, the temperature of the lubricating oil used must be carefully controlled at all times. During warm up periods the oil must be heated to a predetermined temperature in order to speed test work. After the engine reaches normal operating conditions, the temperature of the oil must be kept below certain limits.

An important producer of aircraft engines wanted one unit to do both jobs. In addition, the unit had to meet the demands of mass production in the aircraft engine factory. It had to be compact, light in weight, and portable so that it could be moved from test cell to test cell. The unit, even though light in weight, had to withstand 30 psi oil pressure. In addition to all this, the unit had to be easy to clean. Therefore, the connections to oil, steam and water lines had to be easily made and broken.



Steam at 25 psi pressure was the most convenient heating medium. Water at 70 F was available in only limited quantities for cooling purposes.

With these rigid specifications, development engineers went to work. First they provided an extended surface coil through which either steam or water could be circulated. Instead of ordinary fin spacing, they arranged the fins so that the coil could be easily cleaned and so that oil clogging would be eliminated.

Then the heat transfer surface was attached to a base that provided for steam, water, and oil connections. Over this assembly they placed a cover that formed a reservoir for the oil. For maximum strength, external ribbed reinforcements were used, thus permitting uninterrupted oil flow within the unit. The cover was sealed in place with neoprene gasket and easily removable cap screws.

With this ingenious arrangement, they went a step further than the rigid specifications required. They provided a unit that could be cleaned without disconnecting steam, water, or oil piping, thereby saving precious minutes in the testing of aircraft engines.

The oil to be conditioned is pumped into the bottom of the unit where it is permitted to circulate around the coil. Either the steam or hot water is circulated through the coil, depending upon the temperature conditions desired in the oil. After the oil has been treated in this manner, a standpipe in the unit permits the oil to be

PETRO

REG. U. S. PAT. OFF.

OIL BURNING SYSTEMS

are only available—"for duration", on orders carrying high preference ratings.

BUT—

Petro service, parts for necessary maintenance, and engineering consultation and services, are still fully available.

AND—

hundreds of Petro Oil Burning Systems are meeting unprecedented steam demands in war production plants everywhere;

—24 hour operation, far above normal ratings, day after day, week after week;

—a "break down" test on a gigantic scale which Petro equipment is meeting efficiently, economically, reliably, and without breaking down because ample reserve strength and wear has always been built into Petro.

In addition to being proud of such performance, we think it is a good thing for the heating trade to remember against the time when conditions again permit the free selection and installation of normal industrial and commercial firing equipment.

OIL IS AMMUNITION
USE IT WISELY

PETROLEUM HEAT AND POWER COMPANY
Makers of Good Oil Burning Equipment Since 1903
STAMFORD CONNECTICUT

VICTORY

A SHORT, SHORT STORY of *the breakfast table..* AP *dependable valves* *and* YOU!

Victory starts at the "breakfast table"—with good nourishing food that puts fight and courage, and strength into soldiers and workers alike.

Refrigeration Equipment, keeping this food fresh and healthful, is serving an important Wartime duty . . . And must continue to do so WITHOUT REPLACEMENT PARTS AND EXPENSE if possible.

To YOU, Refrigeration Service Engineers, this offers a distinct challenge to skill and ingenuity. When you MUST use A-P DEPENDABLE Valves to help you, your Industry relies upon YOUR judgment in buying these Valves and other parts ONLY AS ABSOLUTELY NEEDED.

It's our Victory effort to see that all metals, materials and man-power be concentrated on Weapons of War.
We know you will cooperate.

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AP DEPENDABLE *Refrigerant Valves*

WELDOLETS·
TRADE MARKS REG. U. S. PAT. OFF.
THREDOLETS
. . . Welded Outlets for Piping . . .

How to Make Right-Angle Welded Branch Pipe Outlets Stronger, Better and at Less Cost

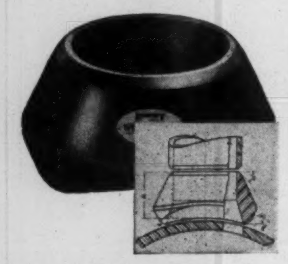
WELDOLETS, ThredOlets and Socket-End WeldOlets overcome every fault and weakness of pipe-to-pipe welded intersections.

They eliminate all templets . . . the fitting is used as a templet . . . the necessity of cutting a symmetrical hole in the main pipe . . . shaping the end of the branch pipe to fit that hole . . . the sharp, right-angle turn which sets up stresses and weakens the junction . . . turbulence and friction, which restricts flow, caused by the sharp 90° turn.

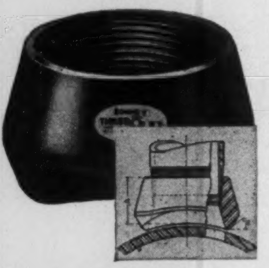
WeldOlets, ThredOlets and Socket-End WeldOlets are designed to produce wide, funnel-shaped, right-angle welded branch pipe outlets which reduce turbulence and friction to a minimum, producing better flow conditions.

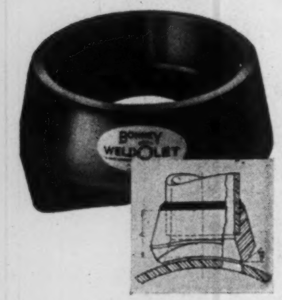
Their heavy, external rib amply compensates for loss of strength in the main pipe when the hole is cut . . . providing a 90° outlet with full pipe strength. This external rib and the wide base eliminates the need for extra braces to take care of bending and vibrational stresses at the junction. No templets are required for their installation.

Their ease of installation and low first cost make them the ideal fitting to use in making right-angle welded branch pipe outlets. Available for all standard pipe sizes and for all commonly used pressures and temperatures, they belong in every welded piping system.


WELDOLET

Showing the external rib and the blending of ear portion of fitting to pipe wall. Note ease of inspecting inside of joint for excess weld metal.

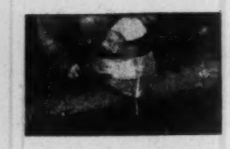

THREDOLET

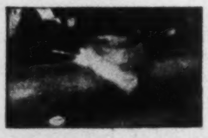

Socket-End WELDOLET

Your local distributor will be glad to give you the full story of WeldOlets, ThredOlets and Socket-End WeldOlets or write for Bulletin WT29 —TODAY.

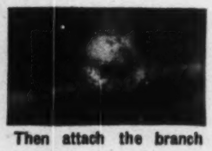
WeldOlets, ThredOlets and Socket-End WeldOlets make it possible to take branches off close together. Cutting, threading and fitting of main pipe is eliminated.

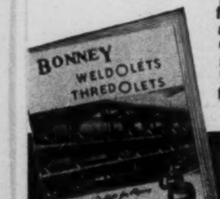
EASILY INSTALLED


Mark center lines and tack the fitting into place.


Then weld the fitting to the main pipe.

Remove the button, which will also permit inspection of the inside of the joint.


Then attach the branch pipe.


Bulletin WT29—20 pages packed with information and data on advantages of WeldOlets, ThredOlets and Socket-End WeldOlets. Write for your copy NOW.

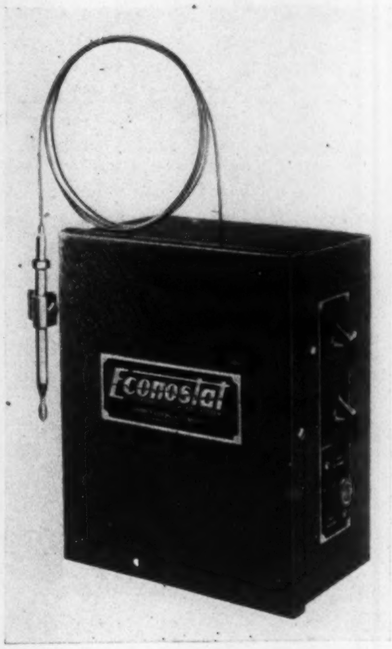
BONNEY FORGE & TOOL WORKS
FORGED FITTINGS DIVISION
ALLENTOWN, PA.

drained off and returned to the test cell ready for use.

So successful has been the operation of this oil heat exchanger that it has been included as a regular product in the manufacturer's wartime products line.—Trane Co., La Crosse, Wis.

Improved Heating Control

No. 2312—The improved "Econostat" is used to regulate heating systems in apartment buildings, office buildings, hotels, factories, etc. It is intended for those installations which cannot be satisfactorily controlled from a single thermostat. The external appearance of the device has not been changed, but it now has a new operating mechanism with a ball bearing drive motor.



The heating system of the building is regulated directly from the outdoor temperature by supplying the heat at intervals. It maintains the desired indoor temperature by varying the "heat on" periods in accordance with outdoor temperature changes. Thus, the heat supplied to the building is in proportion to the heat loss from it.

This control is readily installed in either new or existing buildings, for any type of heating system whether it be fired by a gas or oil burner or stoker, or uses central station steam.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

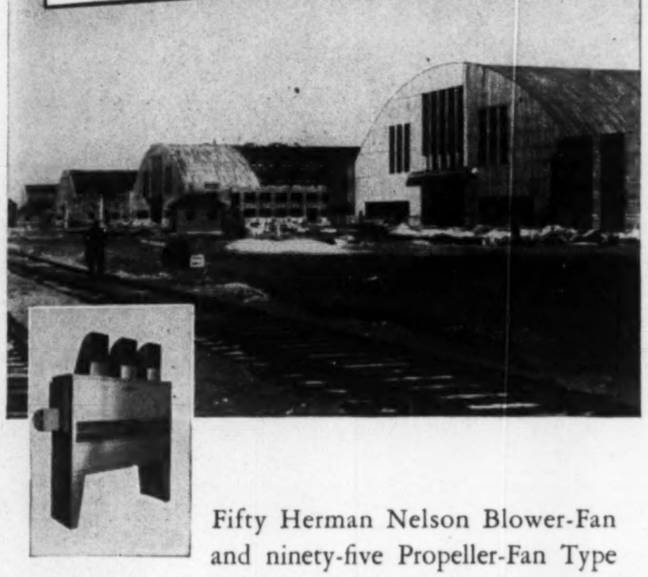
Water Service Pipe and Fittings

No. 2313—A new water service pipe known as "Type K Tube-Loy" is extruded from an alloy of lead, magnesium, calcium and tin. According to the manufacturer, the physical characteristics of lead, the principal component of the alloy, have been so improved by the introduction of carefully controlled percentages of the other elements that the lead's utility has been considerably extended and increased. It is stressed that this is not an emergency product but was widely used prior to current shortages in other water service pipe.

Also offered in conjunction with this product is a line of "Superseal Flared Tube-Loy" fittings which are cast from high quality, air furnace, malleable iron and galvanized to resist corrosion. They have a long tapered flare to provide a large contact area.

These products are recommended by the manufacturers solely for conveying water from the main to the meter.—American Smelting & Refining Co., 120 Broadway, New York, N. Y., and Grinnell Co., Inc., 260 W. Exchange St., Providence, R. I., respectively.

HERMAN NELSON hiJet HEATERS INSTALLED AT WESTOVER FIELD ARMY AIR BASE



Fifty Herman Nelson Blower-Fan and ninety-five Propeller-Fan Type hiJet Heaters have been installed in the hangars of Westover Field Army Air Base at Chicopee Falls, Massachusetts. These heaters are large enough to heat 550 average size homes.

Herman Nelson hiJet Heaters have been installed in hundreds of buildings at Air Bases, Navy Yards, Arsenals, Camps and Forts vital to National Defense. The complete line of hiJet Heaters includes Horizontal Shaft Propeller-Fan, Vertical Shaft Propeller-Fan, Blower-Fan and De Luxe Types. There are 263 models, sizes and arrangements, so you can select the exact unit to solve practically any heating problem most satisfactorily and economically.

AUTOVENT FANS AND BLOWERS have also been installed in many Defense Projects. This quality equipment is manufactured by the Autovent Fan and Blower Division of The Herman Nelson Corporation. All Autovent Products are tested and rated in accordance with the Standard Test Code as established by the National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers.

Autovent Type HB Blower

THE HERMAN NELSON CORPORATION
MOLINE, ILLINOIS

Manufacturers of Quality Heating, Ventilating and Air Conditioning Products

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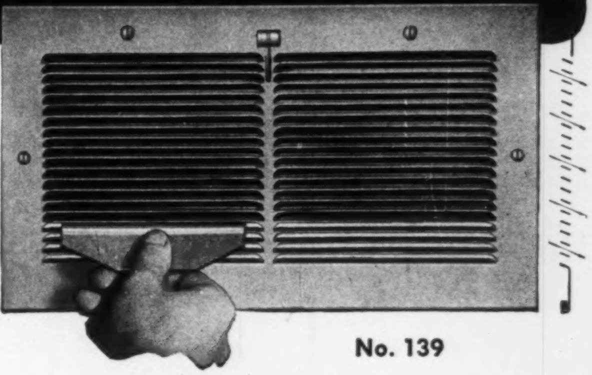
INDEPENDENT
WROUGHT STEEL
Air Conditioning Registers



No. 139

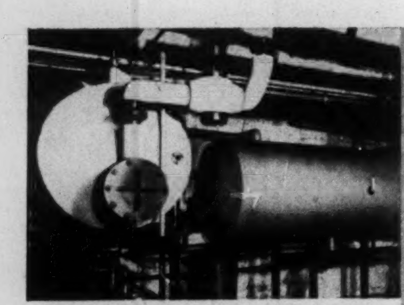
Flexible Grille Bars Make Adjusting Easy

Always Leading. Always Progressing

This modern Independent register has attained great popularity because it presents fine appearance and high efficiency at moderate cost. The grille bars are formed of sheet metal and come regularly adjusted to direct air flow slightly downward. Being flexible, they can be bent to direct air flow to any other desired angle, upward, downward or straight outward. Materials and workmanship are of first quality. Valve is positive, free working and stays firmly in position.

Write for Catalog 41-AC

THE INDEPENDENT REGISTER CO.
3747 EAST 93rd STREET
CLEVELAND, OHIO



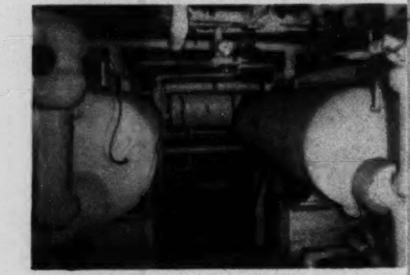
Lincoln High School, Seattle, Wash.

WHITLOCK STORAGE HEATERS
......IN SCHOOLS AND COLLEGES

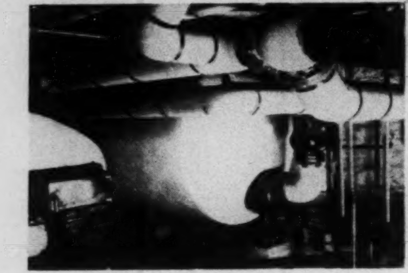
While present conditions greatly restrict our production of Whitlock Storage Heaters, we can point out that many schools and colleges throughout the country are well protected for the duration because they selected Whitlock Storage Heaters with Everdur shells—a combination which is good for a lifetime.

In planning now for after the war replacements, you will do well to think in terms of Whitlock Everdur Heaters! Write for Bulletin 40. In the meantime, should your present hot water supply fail, we shall be glad to do anything permitted by WPB rulings.

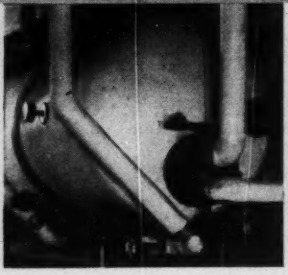
THE WHITLOCK MANUFACTURING CO.
44 South Street, Elmwood, Hartford, Conn.
District Offices in New York, Boston, Chicago, Philadelphia, Detroit, Richmond



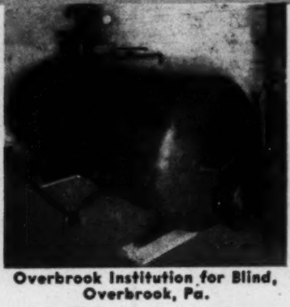
Union Theological Seminary, New York, N. Y.



University of Vermont, Burlington, Vt.



Miami University, Oxford, Ohio



Overbrook Institution for Blind, Overbrook, Pa.

College of William and Mary, Williamsburg, Va.

...to get MORE Refrigeration with your present compressor •plus power savings•install the NIAGARA *Duo-Pass* AERO CONDENSER

In hot weather, reducing the head pressure from 195 lbs. to 165 lbs. adds 10% to 15% extra capacity to your refrigeration system.

Users of the Niagara Aero Condenser, with the new patented Duo-Pass, have gained such advantages—and have saved from 15% to 35% of power, and 95% of water, consumed by present equipment.

These savings are permanent, because the Duo-Pass pre-cooling prevents clogging of condenser tubes with scale; inexpensively gained because the Aero Condenser replaces both cooling tower and shell-and-tube condenser.

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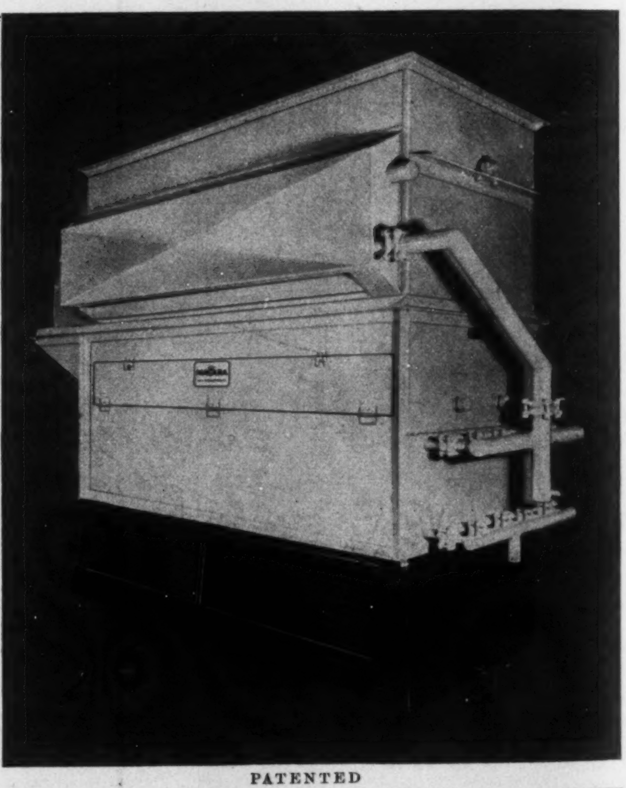

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NIAGARA *INDUSTRIAL* COOLING • HEATING • DRYING
HUMIDIFYING • AIR ENGINEERING *EQUIPMENT*

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page III. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to HEATING, PIPING & AIR CONDITIONING.

Air Conditioners

No. 4229—Series of cards to be placed in hotel rooms instructing patrons on how to get best results from room air conditioners. There are five cards, each covering a different model of the manufacturer's "Weathermaker."—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Air Conditioning, Refrigeration and Heating

No. 4230—12 p. condensed catalog (A-C) of air conditioning, refrigeration, and heating equipment, featuring partial listing of many war industries in which such equipment is used. Specifications, dimensions, weights, etc., are included.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Air Diffusers

No. 4231—8 p. bulletin (F-1497-2) describing and illustrating functions and construction of "Venturi-Flo" overhead air diffusers with information on the recessed, surface, flush, and thermostatically controlled types, the last for extreme mounting heights.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Air Purification

No. 4232—4 p. folder featuring advantages of air purification to allow maximum use of recirculated air. It is stated that 3 tons of installed refrigeration and 100,000 Btu of installed heating equipment is saved (on the average) for every 1000 cfm of air "recovered."—W. B. Connor Engineering Corp., Dorex Div., 114 E. 32nd St., New York, N. Y.

Belt Vulcanizers

No. 4233—4 p. catalog section (2158) on portable electric belt vulcanizers for splicing and repair, an important adjunct to rubber belt conservation.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

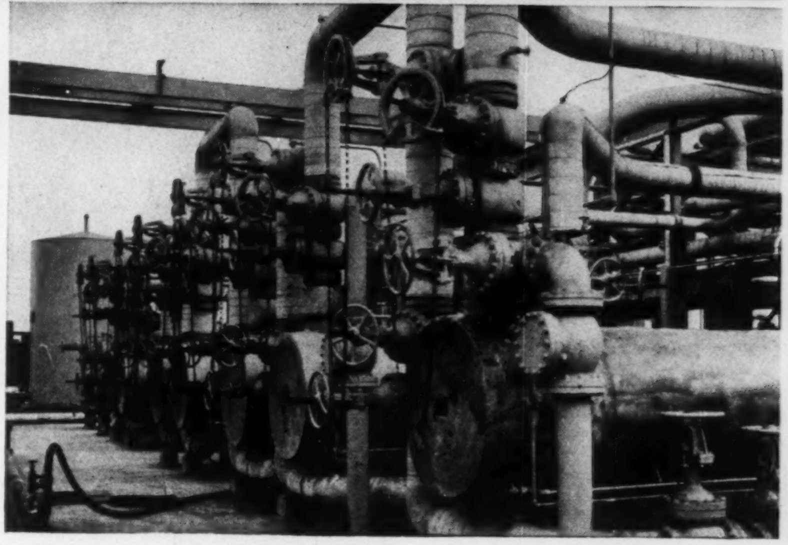
Brazing Brass Tubing

No. 4234—4 p. issue of "Flashes," featuring the "Tempobrazing" of thin wall brass tubing at high speed. Equipment for performing the operation is illustrated.—Thomson-Gibb Electric Welding Co., 161 Pleasant St., Lynn, Mass.

Brazing Fabricated Copper Piping

No. 4235—8 p. booklet on silver alloy brazing of fabricated copper piping, describing the procedure and covering annealing silver alloy brazed copper piping, branch outlets and pipe reduction, brazing branch outlets and flanges to fabricated copper pipes, and brazing of circum-

RU-BER-OID Insulations
aid in the production of



High Octane Aviation Gasoline
TO KEEP THEM FLYING
Synthetic Rubber
TO KEEP THEM ROLLING

Above is an interior view of Standard Oil Company of New Jersey Refinery. Designed by Standard Oil Development Co. *General Contractor:* Arthur G. McKee Co., Cleveland, Ohio. *Insulation Contractor:* Magnesia-Asbestos Insulation Co., New York. RU-BER-OID Insulation Products Used: 85% Magnesia; High Temperature and Sponge Felt Pipe Covering and Blocks; Coverkote; Grade AA Asbestos-Cement.

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All three contribute to insulation efficiency. The Ruberoid Co. offers you all three to custom-build each insulation job. Should any Ruberoid insulation product be temporarily withdrawn from the market, or priority orders make deliveries long delayed, Ruberoid will suggest other insulating materials—that may be substituted without the loss of efficiency.

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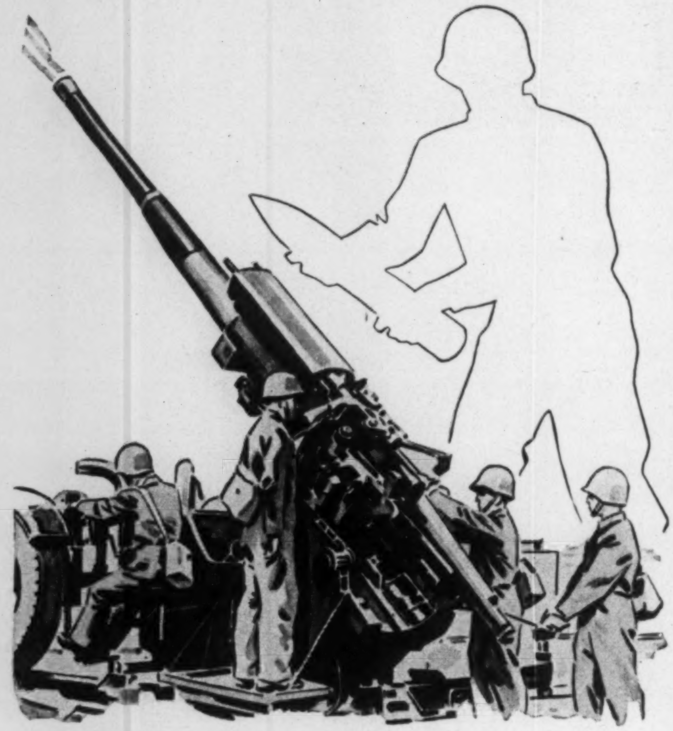
For HEATING · COOLING · AIR CONDITIONING



ARE YOU THE *Invisible Man* BEHIND THIS GUN?

Into every Patterson Hot-Water Storage Heater goes enough steel to make a 105 mm anti-aircraft gun. Multiply that in terms of nation-wide heater requirements, and what is the result? Enough long-range A.A. guns to put up a withering curtain of fire against enemy air armadas.

Your willingness to do without a new Patterson heater . . . your cooperation in getting maximum service out of present equipment helps to put one more gun on the firing line. In a very real sense, that makes you an important member of the sweating crew behind that gun.

Of course, hot water storage heaters are pretty important items in themselves. That depends on the use or industry for which they are intended. But the necessities of war require that the materials from which they are fabricated be rationed strictly according to priorities. If your priority ratings justify the use of the steel or other strategic metals required to fill your orders, Patterson-Kelley will continue to supply you with heaters and all types of heat-transfer equipment.

PATTERSON-KELLEY HEAT EXCHANGE ENGINEERS PK EST. 1880

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ferential rings on expansion joints.—Handy & Harma
82 Fulton St., New York, N. Y.

Centrifugal Pumps

No. 4236—2 p. leaflet on "Type CY" single stag open impeller, centrifugal pumps for belt or motor driv —for pumping hot or cold water, light oil, drainage o process waste, and similar liquids.—Worthington Pum & Machinery Corp., Harrison, N. J.

Chemical Effects in Refrigeration Systems

No. 4237—4 p. issue of "Artic Service News" (Vol. 8, No. 1) on chemical effects in refrigerating systems, including corrosion, copper "plating," freeze ups, oil deterioration, solvent effects, and miscellaneous reactions. —E. I. du Pont de Nemours & Co., Inc., Electrochemicals Dept., Wilmington, Del.

Control and Measuring Instruments

No. 4238—16 p. bulletin (Z6000) giving a condensed listing of the manufacturer's principal control and measuring instruments, including the "Flame-otrol" combustion safeguard for furnaces, boilers, and ovens, and an all purpose controller which may be used for boiler feedwater control.—Wheelco Instruments Co., 1933 S. Halsted St., Chicago, Ill.

Housings

No. 4239—4 p. issue of "The Designer" (Vol. 1, No. 3) discussing how the use of "Lindsay Structure" saves

FULL ACTIVE GRATE SURFACE WITHOUT DEAD PLATES

Frederick STOKERS

MAINTAINS A LOW COMBUSTION RATE PER SQ. FT. OF AREA

★ More grate area, but low combustion rate per square foot of area! . . . Frederick Stokers have specially designed tuyeres with air ports so arranged and proportioned as to insure correct air distribution and maximum efficiency in combustion. Enclosed wind-boxes with two clean-out doors, another exclusive Frederick feature, eliminate possible air leakage through brickwork. . . .

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steel. Among the applications are air conditioners.—Dry-Zero Corp., Merchandise Mart, Chicago, Ill.

Maintenance Chart for Electrical Apparatus

No. 4240—Pasteboard maintenance check chart, 16½ x21½ in., for posting on plant bulletin boards, covering motors, controls, lightning arresters, wiring, fuses, and transformers.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Plastic Cork Coating

No. 4241—2 p. bulletin (7-B) on "NoDrip" plastic cork coating, giving facts about its uses and applications, which include cold water pipes, tanks, ducts, blower pipes, cyclones, dust collectors, etc.—J. W. Mortell Co., Kankakee, Ill.

Power Plant Equipment

No. 4242—24 p. catalog (142) describing line of power plant equipment, including pump valves, water gages, steam pump governors, gage cocks, high pressure steam traps, feedwater regulators, alarm columns, and check valves.—Williams Gauge Co., 1620 Pennsylvania Ave., N. S., Pittsburgh, Pa.

Pump Data Sheets

No. 4243—Looseleaf folder of pump data sheets, including both elementary and advanced technical information on selection, installation, operation, and maintenance

X-PANDO *Pipe Joint Compound*

ONE FORMULA FOR ALL USES

EXPANDS AS IT SETS— ENDS LEAKS PERMANENTLY

6 FOR ONE ECONOMY— CUTS COSTS BY 50%

IT'S THE EXPANSION THAT CORRECTS IMPERFECTIONS IN THREADS

HOLDS ANYTHING CARRIED IN METAL PIPE

NOT AFFECTED BY VIBRATION; WITHSTANDS DEFLECTION, HIGH TEMPERATURES

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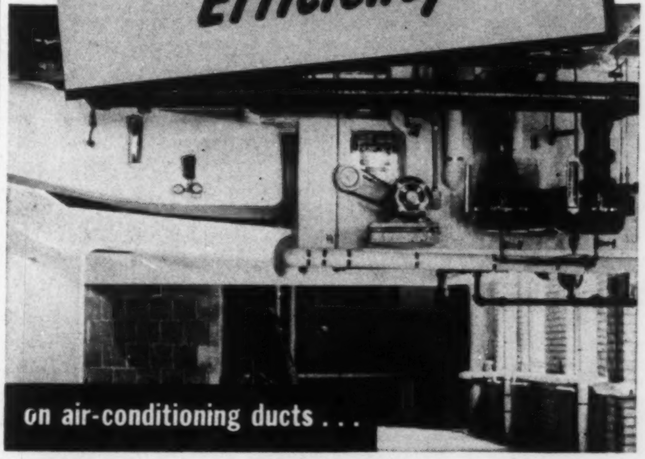

on air-conditioning ducts . . .

on pipe lines . . .

THAT'S NOT JUST A CLAIM. It's a statement of fact based on more than 25 years of outstanding performance on scores of jobs.

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Rock Cork is basically mineral. This means complete freedom from rot and decay . . . strict sanitation . . . no trouble with vermin . . . the end of moisture and mold problems!

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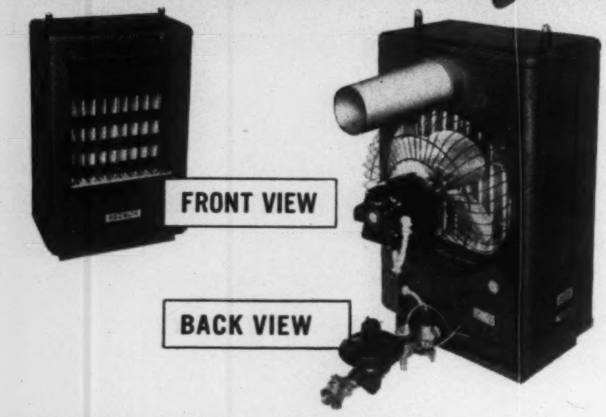
Low-Temperature Insulation
In Sheet Form and for Pipe Covering



REZNOR GIVES YOU A GOOD HEATING PLANT *Quickly*

INSTALLATION ADVANTAGES . . .

Far less installation time . . Requires fewer men . . Uses 89% less vital materials

BROAD PERFORMANCE . . .

Moves more air . . Moves air over wider areas . . Air circulation in summer

LOW COSTS . . .

Lower investment . . Lower maintenance cost . . No boiler room help . . Low fuel expense

Reznor Heaters operate with gas from a suspended position. They give ideal heating and ventilation in factories of all types and sizes. Whether it be for plant additions or for auxiliary heating and ventilation within existing properties, Reznor Unit Heaters offer benefits in installation time, floor space economy, and costs. One hundred and thirty-seven Army and Navy establishments and plants of countless war contractors use them. Reznor Heaters are available in all types and in a complete range of sizes. Write today for literature.

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"GAS HEATERS EXCLUSIVELY SINCE 1888"

of industrial pumps for general and specialized service. A pamphlet of pump fundamentals is included.—Goul Pumps, Inc., Department 34, Fall St., Seneca Fall N. Y.

Rubber Linings

No. 4244—4 p. catalog section (9000) on "Vulcalock" rubber linings for handling corrosives and abrasives. Included is a table listing over 100 of the mo common services for which such linings are suitable, giving limits of temperature and concentration of the flui in each case.—B. F. Goodrich Co., 548 S. Main St Akron, Ohio.

Steam Jet Ejectors

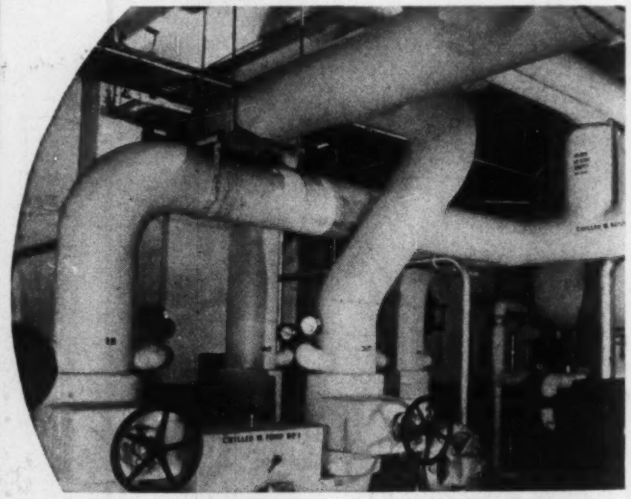
No. 4245—6 p. bulletin (W-205-B7A) on two stage, condensing type, steam jet ejectors, giving informatio on types, construction, steam consumption, engineerin data, etc.—Worthington Pump & Machinery Corp., Harrison, N. J.

Temperature Control

No. 4246—36 p. condensed catalog of information o temperature control products for heating, ventilating, air conditioning and industrial applications, discussing motor operated valves, control motors, thermostats, humidit controllers, program switches, and accessory equipment. —Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Vacuum Return Units

No. 4247—4 p. bulletin (100-A) on vacuum return units, giving specifications, standard and "super" ratings,



Mundet Cork Pipe Covering is made of 100% pure cork, which, due to its low conductivity, holds power costs to the minimum. Its high efficiency permits precise control of low temperature regardless of climate or season • Cold lines, low-temperature ducts, the walls, floors and ceilings of refrigerated rooms should be adequately protected by Mundet Cork Insulation in the form of Cork Pipe Covering and Corkboard • For test data, showing what Mundet Cork Insulation means in savings and operating efficiency, write to Mundet Cork Corporation, Insulation Division, 65 South Eleventh Street, Brooklyn, New York.

MUNDET CORK INSULATION
CONSERVES LOW TEMPERATURE

dimensions, and drawings.—Ames Hydrovac Corp., 290 Scholes St., Brooklyn, N. Y.

Valves

No. 4248—6 p. bulletin on "Faircoseal" bronze valves for "Silbraz" joints, describing the valves and telling how to make the joints with the oxyacetylene torch.—Fairbanks Co., 396 Lafayette St., New York, N. Y.

Weld Inspection Chart

No. 4249—Large arc welding inspection chart for wall mounting, presenting graphically the different types of welds obtained when the work is done normally—with normal current, voltage, and speed—as compared to those obtained when these factors are not normal. The chart also illustrates the "Fleet Fillet" technique of welding for increasing welding speed. — Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

New Spectrum Chart Published

Of special interest to teachers of physics, chemistry, and electrical engineering, and to practicing engineers and scientists, is a new seven color wall chart of the entire electromagnetic spectrum.

Approximately 30 by 40 in. in size, the chart is printed on heavy white cloth, and is bound at top and bottom in ⅜ in., black enameled wooden rods.

Each chart is packed in a substantial closed cardboard tube, and is sent postpaid. The price is $2. Orders should be sent to Publications Section, 6-N-17, Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.

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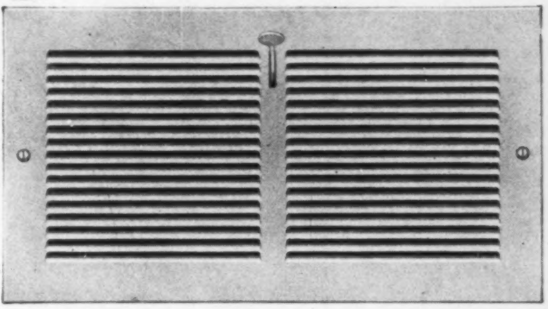
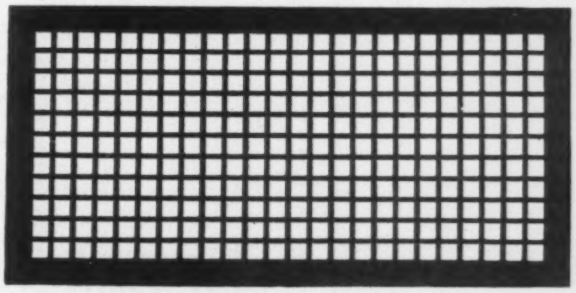
REGISTERS for Low-Cost Homes



Auer offers numerous types of warm air registers to meet the cost requirements of the small home market. In many defense housing projects, such dwellings are being equipped with the "7000" Airo-Flex Series Registers shown above. This is a high grade but inexpensive design with one-piece face, and bendable fins adjustable at time of installation for up or down deflection. This register has a single shut-off louvre, ample free area, and pleasing appearance.

Other Auer models, such as Classic Registers, Heat-Rite Registers, and DuraBilt Floor Registers and Cold Air Faces, are well adapted to use in smaller homes.

Write for Auer Register Book showing all models for warm air and air conditioning, or for Catalog "G" on flat metal grilles.



Flat Stamped Metal Grille (Lattice Design)

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3608 Payne Avenue Cleveland, Ohio

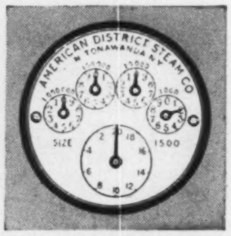
AUER REGISTERS & GRILLES
For Air Conditioning *and* Gravity

LET THESE

METERS

HELP YOU ARRIVE AT ACCURATE STEAM COSTS

● Don't guess. Make accurate charges for steam against different departments, processes or buildings. Find out when and where your peak loads occur. Detect steam losses. Install ADSCO Rotary Condensation Meters.



METER COUNTER

Records in pounds of condensate on a Non-Fogging Dial.

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Quickly installed — easily maintained! Factory-tested for accuracy within 1%! These efficient LOW PRICED meters are the standard in leading industrial plants, colleges and institutions.

Seven sizes, 250 - 12,000 lbs. per hour capacity.

Write for quotation, advising us the maximum pounds of condensate per hour or the equivalent direct radiation in the building or department. Also ask for Bulletin 35-80HP.

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ADSCO ROTARY CONDENSATION METER

Combines High Accuracy With Low Cost

Useful Information

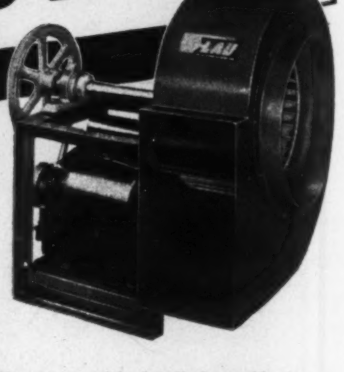
Introduction to Heat Transfer

Several books on heat transfer have appeared in recent months. Intended primarily as references rather than texts, they have contained much data on heat transfer, but have not been organized in such a way as to make them suitable for texts. Valuable because of the vast amount of data in them, the presentation has not always been organized in the logical, step by step style required for a text book.

Introduction to Heat Transfer, a new book by Aubrey I. Brown and Salvatore M. Marco (of Ohio State University) amply satisfies the text book requirement that the presentation be made in a logical step by step style. It covers the entire field of heat transfer. The material is clearly presented. Moreover, the large number of illustrative examples presented help the student to grasp the application of the various methods and formulas.

There are 12 chapters. The first three cover the introduction and the subject of heat transfer by conduction. The fourth covers radiation. The next three chapters deal with forced convection; and the eighth and ninth with boiling and condensing vapors. The 10th and 11th chapters deal primarily with the applications of the principles covered in the earlier chapters to the design of actual heat transfer equipment. The 11th in particular is very much worth reading. The 12th chapter covers

LAU SINGLE INLET BLOWERS



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V-Belt Drive Illustrated.
Standard Stock Units in 10 Sizes
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Write for new descriptive literature with detailed specifications. Lau engineers will be glad to help you solve your air-handling problems. Whatever they are—"Leave it to Lau."

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the subject of variable heat flow in solids—that is, the subject of heat flow which varies with time.

All in all, this book is a well written and clear exposition of the subject. Practicing engineers will certainly benefit from reading it.

The publisher is McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. There are 232 + xv pp., 6 by 9 in., and the price is 2.50.

New Welding Standards

The American Welding Society has recently published two welding standards, entitled Standard Methods for Mechanical Testing of Welds, and Definitions of Welding terms and Master Chart of Welding Processes.

The first describes in detail the principal mechanical tests applied to welds, including tests for density, soundness, tensile strength, shearing strength, and ductility (bend tests). The booklet includes sketches of the specimens and descriptions of the methods of testing and evaluating the results.

The other gives the standard definitions of welding terms adopted by the AWS. Fifty-one illustrations assist in making the various definitions clear. The booklet also includes a chart showing the various subdivisions of the principal welding processes: forge welding, resistance welding, arc welding, gas welding, thermit welding, and brazing.

Both of these standards are published in bulletin form, with a heavy paper cover, and are available at 40c a single copy from the American Welding Society, 33 W. 39th St., New York, N. Y.

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ADJUSTABLE
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STANDFORATED Precision Processing provides top quality and super-efficiency at moderate cost. Scientific design, strength and durability meet rigid specifications for all types of Defense Building!

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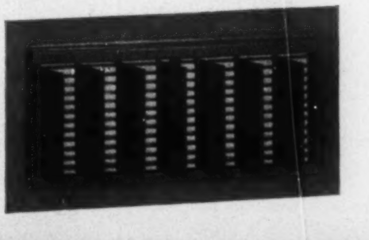
No. 500HA — 4-Way Deflection. Vertical deflecting louvres on back individually operated left or right. Horizontal grille bars on face adjustable in groups for up or down deflection.



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IN REFRIGERATION CONTROL SINCE THE INTRODUCTION OF THE THERMOSTATIC EXPANSION VALVE

KRAMER
Balance Loader
SYSTEM

THE KRAMER Balance Loader SYSTEM (Patented) is a modulating refrigeration system capable of varying from 0% to 100% of full load, and maintaining a fixed minimum back pressure in the suction line and in the compressor crank case.

The KRAMER SYSTEM will automatically compensate for varying evaporator loads, resulting in an infinite number of compressor capacity points, giving straight line capacity modulation.

The KRAMER SYSTEM is the only one that will give a full range of modulation at a fixed minimum back pressure throughout the entire low side.

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MANUFACTURERS OF
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BECAUSE MORE BULK PER POUND

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Mail post card for free sample. Rutland Fire Clay Co., Dept. (H-8) Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patcher.

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Search Your Plant Today
FOR USED
DART UNIONS"

. . . and Put Them Back to Work to Conserve Vital Metals

The search is on—in plants all over the country—to find used or discarded Dart Unions. For **two** reasons. First, old Dart Unions now **belong** back on the job and will work as efficiently as ever. Second, by putting used Darts back to work, you help conserve vital metals.

The explanation of why a Dart Union can be used so many times, with absolute assurance of tightness each time, is found in the way Darts are made. Darts have two extra-wide, non-corroding bronze seats, ground to "true-ball" surfaces. And, the nuts and bodies of all Dart Unions are made of High-Test Air Refined Malleable Iron that resists pipe strains, rough handling, rust.

So we say again: don't delay . . . seach your plant for used Dart Unions **today**. If you also need **new** Darts, see your supplier.

DART
UNIONS
E. M. DART MFG. CO., PROVIDENCE, R. I.
SALES AGENTS: THE FAIRBANKS COMPANY NEW YORK AND ALL BRANCHES
CANADIAN FACTORY: DART UNION COMPANY LTD. TORONTO CANADA

Standard Filing System for Architects

The American Institute of Architects, 1741 New York Ave., N. W., Washington, D. C., has published a 1942 edition of its Standard Filing System and Alphabetical Index, for filing information on building materials, appliances, and equipment. Known as AIA document No. 172, it is a paper covered, 63 p., 8½ by 11 in. booklet which is sold for $1.00. New developments and advances since 1937, when the previous edition appeared, have made necessary the current revision.

This scheme is rather widely used to simplify filing and make it possible for an adequate file of informative trade catalogs and literature to be maintained. The engineer specializing in heating and air conditioning will, however, find it quite general for his use. For example item 30-E, Temperature Regulation and Control, has but one subdivision, 30-E-1, Thermometers. Also, the entire field of industrial and commercial air conditioning comes under but one subdivision, 30-F-2.

Sound Measurement Code for Fans

Demand for lower sound levels in the operation of machinery generally has influenced the members of the National Association of Fan Manufacturers to adopt a standardization program covering those types of fans designed for application in, and furnished under specifications for, air conditioning, heating, ventilating and general air handling problems. These standards are published in the NAFM form X-12.

In order to provide a standard method of measuring sound in fans and blowers, this association has prepared

STOP that...DRIP!

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

NO Drip A SURE CURE

This sensational plastic cork coating is easily applied with whisk broom, brush, trowel or spray to metal, concrete, brick, wood, plaster or composition surfaces. Insulates and prolongs life of pipe and other metal by preventing rust and corrosion.

Produces a permanent, stucco-like finish that requires no maintenance. Can be painted any color. A gallon covers about 30 feet of 1" O. D. pipe. Comes in 1, 5 and 55 gallon drums.

Order from your supply house or write for circular.

J. W. MORTELL CO., 512 BURCH ST., KANKAKEE, ILL.

the Sound Measurement Test Code for Centrifugal and Axial Fans, bulletin No. 104. Incorporated in the code are standards previously adopted or tentatively accepted by authoritative bodies such as the American Standards Association and the U. S. Navy. The code, therefore, establishes a commonly used method of sound determination to give designers and users a relative idea of sound determination.

Address of the NAFM is 5-208 General Motors Bldg., Detroit. Price of the code is 10c.

Fuel Engineering

Appalachian Coals, Inc., Transportation Bldg., Cincinnati, has recently issued an 86 p., 8½ by 11 in. general index to the 26 fuel engineering conferences sponsored by its fuel engineering division. This index contains the same material as the first general index, plus conferences 23 to 26.

Oil Burner Handbook

In general, the new book, An Oil Burner Handbook, by L. J. Whelan, deals with domestic oil burners, but also devotes a section to industrial burners. A single illustration of the erroneous treatment of domestic burners will suffice. Speaking of domestic rotary burners, the author fails to distinguish between atomizing types and vaporizing types, mentions both as though they were identical in principle, (actually the two burners are about as alike as a diesel engine and a steam engine) and covers the refractory hearth of the former and the steel vaporizing ring of the latter in implied similarity with: "When

INFORMATION

"COMMERCIAL" STANDARD STEEL SHAPES
Section No. 2
"COMMERCIAL"

In these booklets will help manufacturers converting to defense work.

The Tank Head Price List—all kinds of standard tank heads.—Stamping Catalog for special parts to order—Shows what we can do.—Shapes Booklet for saving in tool and die costs, by using our standard parts—One or a Carload.

Write for one or all

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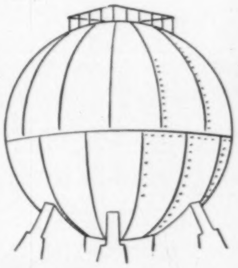
YOUNGSTOWN, OHIO

SPRAYED INSULATION

SPRAYO-FLAKE Insulation (Thermal Insulation 0.246 B.t.u.) . . . is easily and inexpensively applied by AIR GUN in *any desired thickness* to *any surface or contour.* SPRAYO-FLAKE is a "tailor made" resilient, monolithic insulation . . . is moisture-proof, fire-safe and will not deteriorate. Special coatings for exterior use.



IDEAL FOR
STORAGE TANKS

SPRAYO-FLAKE'S Air Gun Application makes it ideal for insulating storage tanks . . . for it prevents condensation and its natural adhesive base allows it to conform to any contour, and form a permanent, weather-proof blanket of insulation without the use of mechanical fastenings of any kind.

SPRAYO-FLAKE also seals all cracks and crevices and is not affected by temperature changes.

Write for complete Industrial Catalog Now!

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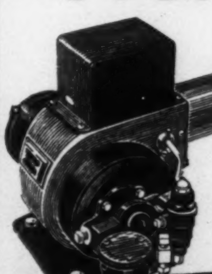


• **Precision . . .** The more precision in manufacturing, the greater efficiency in operation. That's true of machines in general . . . and oil burners in particular! Quiet May, because it is precision-built from start to finish, delivers maximum comfort on minimum fuei. Now that "oil is ammunition," Quiet May is helping thousands of homes to "use it wisely." May Oil Burner Corp., Baltimore, Md.

QUIET
MAY
OIL BURNERS
"SUPPLIERS TO UNCLE SAM"

Waterloo
AIR DIFFUSION EQUIPMENT

- Adjustable Directional Grilles
- Louvres . . . Vanes . . . Diffusers
- Dampers . . . Ventilators

. . . reflecting the fine craftsmanship and design that have characterized Waterloo products for over 40 years.

WATERLOO REGISTER CO.
Waterloo, Iowa **Seattle, Wash**
Representatives in Principal Cities

CONTROL OF SELECTION — SIZE — THROW — VOLUME — DIRECTION

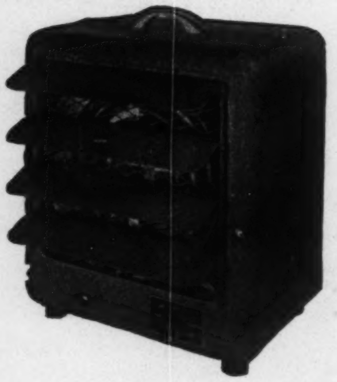
Order CHROMALOX
Electric Air Heaters *Now—*

and postpone for weeks Fall boiler plant operation.

Don't wait until the first snappy day to look into the savings of electric heat. Check now on your requirements and meet early Fall weather with heating comfort for shop or office that goes on or off at the snap of a switch . . . costs little while working, nothing while idle . . . gives instant warmth . . . can be installed anywhere, as easily as an electric light—and this means the distant gate house as well as the main plant or office . . . and works whenever you want it, nights, Sundays, holidays, with no overtime extra cost.

In the dead of winter, these heaters will help out the boiler plant, saving exceptional steaming rates. They save man-power, fuel, prevent discomfort, ill-health.

Order NOW to insure early Fall delivery.



Above is the type HF heater made in four sizes from 1.5 to 4-kw. Graceful enough for the finest office, practical enough for any shop. Other types up to 40-kw. for large areas. Thermostatic control if desired.

Write for the Chromalox Book of Electric Heat, often used as a handbook by shop executives and engineers. Describes units for all industrial heating needs.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. **Pittsburgh, Pa.**

installing or servicing this burner, keep it absolutely level to permit the oil spray to strike the center of the firing ring, which is the part of the hearth next to the boiler wall." There are given a plan view of a vaporizing ring and a sectional view of a refractory hearth and both are designated "rotary burner." Perhaps there has been a cross breeding of the diesel and steam engines. But the author must have felt uneasy about his burner backgrounds, for he says: "Due to various burner designs, the mechanic should know the rotary burner firing method, namely the wall wiper flame and the halo flame. . . ." Unfortunately, he does not offer a suggestion in his book as to how the mechanic is to acquire this knowledge, and surely no attempt is found in the book to convey this information. Please note that in the quoted sentence *method* is singular, not plural.

Under industrial burners the author confuses various burner types, to which factual confusion is added an unfortunate carelessness in English: "Pressure burners are atomized by internal pressure only. These burners require preheated oil; they are, however, often termed rotary cup burners."

This literary artistry pervades the entire book: "Strainers are best cleaned by closing the oil valve at the burner to prevent oil from flowing into the strainer." Or again, "This soot is the residue matter left from the fully burned fuel which passes out through the chimney with the gases." The author effectually scrambles his ideas and his syntax: "If the reader faithfully carries out all the above instructions and the burner still does not start, then you had better telephone for a service man." More: "Boilers can be adapted to steam atomization only when they have more than 100 pounds of steam pressure; the excess steam is utilized by this atomizing."

Industrial high pressure atomizing burners find their chief utility in large plants, central stations and marine (especially naval) boiler rooms. Hence it must be a distinct surprise to the qualified burner man to read: "The internal pressure burner is better used for the smaller plant than for the larger." When treading on too delicate ground the book wisely steps softly: "Check vacuum lift with a vacuum gage. Too high or too low vacuum are equally bad." One is reminded of the little girl's definition of salt—a substance that spoils everything you don't put it on.

Coming Events

Welding in War Production

American Welding Society: Annual meeting, October 12-16, Hotel Cleveland, Cleveland, Ohio, in conjunction with National Metal Exposition to be held in Cleveland Public Auditorium the same week. Theme of the meeting will be welding in war production, and technical sessions will include welding of aircraft, ships, tanks, and ordnance materiel; training welding operators and qualification; localized heat treatment; residual stresses and their relief; weldability of steel; gas cutting; resistance welding fundamentals; brazing and soldering; structural design; and non-destructive tests and inspection. Headquarters office of the AWS is at 33 W. 39th St., New York, N. Y.

THE EDITOR'S PAGES

GOVERNMENT DEPARTMENTS BUILDING COAL STORAGE PILES

Federal government departments in the nation's capital are building a 125,000 ton coal storage pile in addition to their regular maximum storage capacity as an emergency reserve for protection against possible fuel supply interruptions next winter, Solid Fuels Coordinator for War Harold L. Ickes said last month.

Commending the building of the coal reserve as an excellent example to home owners, business, and industrial interests throughout the country, Coordinator Ickes said that he had been informed that approximately 120,000 tons of bituminous and 5000 tons of anthracite are being put in the reserve storage piles located on temporary sites.

"If sufficient storage of coal is built up this summer, there will be much less likelihood of coal shortages next winter to interfere with the war effort and cause possible suffering," Coordinator Ickes said.

Reports reaching him indicated that adequate supplies of soft coal for storage purposes may be less available after early September, the Coordinator stated.

The coal going into reserve piles in Washington includes some 100,000 tons of bituminous being stocked by the procurement division of the Treasury Department in cooperation with the Public Buildings Administration, and approximately 20,000 tons of bituminous and 5000 tons of anthracite being stocked by the Navy Department. The Treasury's procurement division buys the supplies for the Capitol power plant, which furnishes heat to the Capitol, and to the Senate and House office buildings, and for the central heating plant, which furnishes heat for most of the government buildings in the city. The Navy Department's purchases are for the Washington navy yard.

Both piles are being built purely for emergency use in Washington, it was emphasized, and regular large storage facilities supplied by the two departments have been filled to capacity with coal stocks. The Navy has been building its storage of coal at various land stations since last April. While both departments ordinarily carry a substantial volume of coal in storage, they have relied in the past for a considerable share of their winter coal requirements on current deliveries. A number of states and municipalities throughout the country likewise are reported to be augmenting their regular storage facilities by building extra coal piles.

WPB ADVISES PLANT OPERATORS TO OBTAIN GRATES AND STOKERS

Plant operators and home owners should make immediate arrangements to obtain the grates and stokers needed to convert fuel oil burners, and at the same time, arrange to purchase the necessary amounts of coal, the WPB plumbing and heating branch said last month.

The branch pointed out that the action of WPB in setting aside 11,000 tons of material needed for conversion will have served its purpose only if manufacturers receive the orders on which to base their applications for allocations of materials.

Attention was called to the joint statement of OPA Administrator Leon Henderson and Petroleum Coordinator Harold L. Ickes advising every user of oil heat in the eastern area to take immediate steps to prepare for a fuel oil shortage this winter.

Industrial plants desiring to obtain stokers for conversion purposes should file an application for a preference rating with the plumbing and heating branch. Manufacturers of these types of equipment should make applications for materials to the plumbing and heating branch on form PD-25-f, if they are under the production requirements plan, or on form PD-1a if they are not.

RESTRICTS CRITICAL MATERIALS IN STEAM CONDENSERS

The use of less critical material in tubing and tube sheets for steam surface condensers used in land installations of power generating equipment was ordered in schedule II to WPB limitation order L-154 issued last month. The order prohibits the use of copper, copper base alloy, nickel or tin in tube sheets.

The order requires tubings for condensers to be made of admiralty or muntz metal, which are made from copper-zinc alloy. Previously such tubing was made from admiralty and muntz metals and also from more critical cupro-nickel alloy, copper-zinc-aluminum alloy, and some of the tubing was coated with tin.

The order does not apply to condensers for use at sea.

MEETINGS IN FIVE CITIES THIS MONTH TO STRESS CONSERVATION IN AIR CONDITIONING

A series of "all industry" meetings, sponsored by the Victory Program of the Refrigeration and Air Conditioning Industry, is to be held in New York, Dayton, Chicago, St. Louis, and Los Angeles this month. E. T. Murphy is chairman of the September 14 meeting in New York, P. B. Zimmerman is chairman of the meeting on the 16th in Dayton, Frank Smith heads the meeting on the 18th in Chicago, A. B. Schellenberg is chairman of the meeting to be held in St. Louis on the 21st, and Sandy Pratt is handling the September 25 meeting on the Coast.

A detailed plan of conservation will be explained and suggestions will be given to the managements of all companies for their acceptance, elaboration, and execution.

The Victory Program, whose director is John K. Knighton, 119 Morton Ave., Evansville, Ind., is a voluntary movement with the endorsement of the WPB, its object being to contribute to the war effort through conservation, which involves product design, production, application, installation, service, and maintenance.

THE EDITOR'S PAGES

Continued

MILITARY EXEMPTION LIST OF COPPER ORDER REVISED

The director general for operations of the WPB added a number of items to the military exemption list of the copper conservation order M-9-c, in an amendment issued July 30. Copper may be used without limit for the manufacture of these articles when they are ordered by the military services of the U. S. and for certain other agencies. The list includes floats for liquid level control (for use on board ship and in aircraft), and unions and union fittings (for use on board ship).

Additional items were added to the list until September 1, pending further discussion as to their permanent status. Included among these items were air conditioning equipment; fans (parts for conducting electricity only); floats; hot water heaters, tanks, and coils for hospital, laundry and bakery projects; refrigerating equipment; unit heaters, unit ventilators, and convectors, space or local heaters and blast heating coils; and valve handles (for use on board ship).

MORE GAS FIRED EQUIPMENT INCLUDED IN L-79 ORDER

An amendment to limitation order L-79, covering certain heating, plumbing, and cooking equipment, issued last month by the War Production Board, includes the following gas burning heating equipment in the terms of the order: steam and hot water heating boilers, warm air furnaces, floor furnaces, unit heaters, conversion burners, and gas steam radiators.

Order L-79 provides that "no person shall sell or deliver" any equipment covered by the order to an ultimate consumer, except that:

The sale of any equipment needed to convert oil and gas burners to coal is permitted.

No restrictions are placed on sales amounting to $5 or less, provided such sales are part of an order totalling no more than $10.

Sale and delivery is permitted of any equipment on an A-10 or better preference rating. (Preference rating order P-84 assigns such a rating for repair and maintenance purposes.)

Sale and delivery of any equipment is permitted if the purchaser certifies that it is needed to complete a project authorized by WPB in accordance with construction order L-41.

Sale and delivery is permitted on the specific authorization of WPB.

Sale and delivery of any equipment specifically designed for hospitals, or for surgical, veterinary, barber shop, or beauty shop use is permitted.

Cooking stoves, heating stoves and water heaters may be sold to householders where no other equipment for cooking or heating purposes is available.

An additional exception, which permitted the sale of oil burners when such transactions were made for the purpose of reducing consumption of fuel oil, was revoked by an amendment last month.

PROF. LARSON HAS IDEA OF WHAT HIT JAPS AT SOLOMONS

Prof. G. L. Larson, chairman of the department of mechanical engineering at the University of Wisconsin, and a past president of the American Society of Heating and Ventilating Engineers, probably has as good an idea as any of us of what happened to the Japanese in the battle of the Solomons. Back in 1900 and 1901 Professor Larson was a teammate of Vice-admiral Robert Lee Ghormley on the University of Idaho football team. Admiral Ghormley, in command at the Solomons, was "a very good quarterback and strategist", according to Professor Larson in an item published in the Chicago Sun, August 24.

FIRE PREVENTION AN ESSENTIAL CD MEASURE

Fire prevention week is observed every year during that week in which October 9, the anniversary of the Chicago fire, occurs. But this year the war has given fire prevention week — which is to be observed October 4-10—unusual significance.

The nation is preparing to defend itself from fire that may be caused by incendiary bombs. Equally vital is the need to prevent the slowdown of war production by fires that may result from sabotage or ordinary causes. And, at this time when we are facing material shortages, replacements in the home and elsewhere must be reduced to a minimum. The seriousness of the situation has been recognized by every organization concerned with fire safety, and the sponsors of fire prevention week are joined, this year, by the U. S. Office of Civilian Defense, which is charged with civil protection in wartime.

By virtue of the President's proclamation, the OCD calls upon the entire nation to heed the danger of fire, a danger which threatens our lives, menaces the security of our homes, and waits to sabotage war industries.

The elimination of our fire losses cannot be accomplished in a single week, of course. But fire prevention week affords an opportunity to impress upon all of us the necessity for keeping our homes and places of employment safe from fire.

The 10 most common fire causes in the last 10 years were: matches—smoking; misuse of electricity; exposure (fire originating off premises); sparks on roofs; overheated or defective chimneys, flues, etc.; lightning; stoves, furnaces, boilers, and their pipes; open lights; petroleum and its products; hot ashes and coals—open fires.

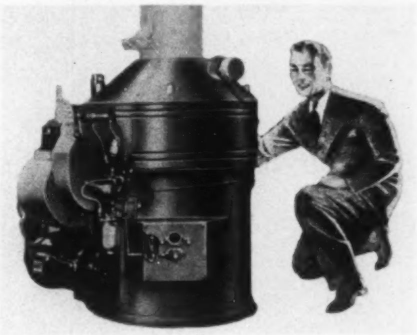
"The goal of the organization must be this—to make a better and better product to be sold at a lower and lower price. Profit cannot be the goal. Profit must be a byproduct. That is a state of mind and a philosophy. Actually an organization doing this job as it can be done will make large profits which must be properly divided between user, worker, and stockholder. That takes ability and character. . . . It must be kept in mind at all times that this is a natural working out of our inherent selfishness.—From Intelligent Selfishness and Manufacturing, by James F. Lincoln, president, Lincoln Electric Co.

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1942, Heating, Piping & Air Conditioning *and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.*

Package Steam Generator

No. 2314—A new "recirculated" type steam generating unit for use wherever there is a demand for a steady source of steam or an emergency unit, produces steam from a cold start to pressures up to 300 psi in less than 2 min, says the maker. It is available in standard "packages" of 500, 1000, 1500, 2000, and 3000 lb per hr evaporation. The unit requires no boiler room or high draft stack. It is completely automatic or semi-automatic, according to the specified requirements.



The staggered steel tube coil assembly is easily removed for cleaning. A single motor drives all necessary units, with water blower and fuel feed controlled by steam demand. Interlocked automatic regulation assures safety. The continuous coil construction is said to assure protection against explosion or escaping steam, even though the steam generator may suffer from external damage of any type, including shell fire.—Vapor Car Heating Co., Inc., 80 E. Jackson Blvd., Chicago, Ill.

Supply and Return Unit

No. 2315—The "Venturi-Flo" combination supply and return (or exhaust) unit has been designed for use on installations where simplification of the duct layout is of primary importance. It is ideally suited for existing building work since the return duct may be run to the same point as the supply duct instead of leading to a register at some other location, says the manufacturer.

The removable center section consists of a series of concentric rings.

A gasket around the outer edge forms a tight seal with the ceiling.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Convectors with Non-Metallic Cabinets

No. 2316—In order to conserve critical material, a new non-metallic cabinet convector to be used in place of all-metallic convectors and radiators has been developed. Except for the screws, the cabinets are constructed entirely of non-metallic materials. Side and top panels are fabricated from rigid fiber board. Supporting members provided at the corners are of hard wood.

The element is constructed of steel fins and tubes. The small amount of metal used in these new convectors is equivalent to one-fifth of that used in the ordinary radiator, says the maker.

Two cabinet types are available, one for wall suspension and the other the free standing floor type. Circular designed grilles are punched in the sloping tops of both cabinets.—Trane Co., La Crosse, Wis.

Unit Heaters of Steel

No. 2317—To conserve critical materials urgently needed for the war effort, a line of steel-condenser unit heaters has been developed. Use of units with conventional copper and copper alloy condensers is restricted to shipboard use and for use outside the continental

For Your Convenience

[9-42]

Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Trade Literature. (*Circle each number in which you are interested*):

2314	2315	2316	2317	2318	2319	2320	2321	2322	2323
2324	2325	2326	2327	2328	2329	2330	2331	2332	2333
2334	2335	2336	2337	2338	2339	2340	2341	2342	2343
2344	2345	2346	2347						
4250	4251	4252	4253	4254	4255	4256	4257	4258	4259
4260	4261	4262	4263						

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Company ....

Address ....

City.............................. State...............

WHITE-RODGERS

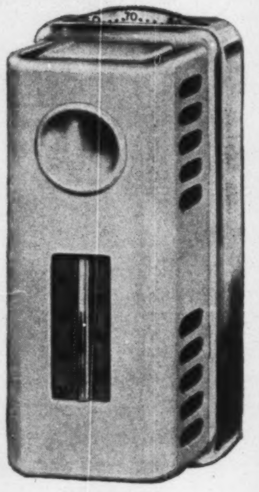
Hydraulic-Action

THERMOSTATS

For Industrial Applications . . .

White-Rodgers Series 150 heavy-duty line-voltage Thermostats for industrial applications will carry many multiple unit heater installations without the need of a relay.

Available with locked dial and "ON," "AUTOMATIC" and "OFF" dial positions which serve as a manual switch for summer fan operation or to turn off the system during temporary shutdowns. (Meets U. S. Army Specifications.)


Series 150

HYDRAULIC ACTION CONTROL

For Hazardous Locations . . .

Self-Contained Type
Series 200

White-Rodgers Explosion-Proof Thermostats are recommended for use in oil refineries, munitions plants, powder magazines, grain elevators, flour mills, cleaning plants and similar locations where explosive fumes or dusts are present.

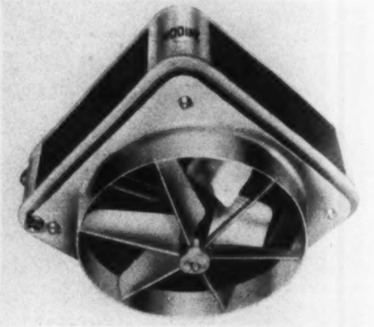
Underwriters approved, both self-contained and remote bulb controls are offered in standard ranges with external knob or tamper-proof internal adjustment.

WHITE-RODGERS ELECTRIC CO.

1205j Cass Avenue, St. Louis, Mo.

United States. The new line, designated as "Style S/S," includes both horizontal and vertical delivery models.

Electrolytic action and its resultant corrosion is combated by using ingot iron for condenser tubes and headers. Tubes have an extra heavy wall thickness of 0.065 in. The steel fins are permanently bonded with metal (also mechanically bonded) to the ingot iron tubes, to seal the vital contact of fin to tube from corrosion.

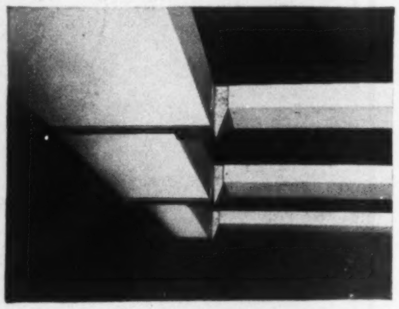


To reduce the possibility of rusting and corroding of fins, and subsequent cutting down of net free area between them, the completed welded and brazed condenser assembly is dipped in a lead alloy bath.

Under WPB order L-107, steel unit heaters can be purchased (1) for the Army, Navy, Maritime Commission and Coast Guard; and (2) for essential industries, by using form PD-412-A.—Modine Mfg. Co., 1772 Racine St., Racine, Wis.

Asbestos Bonded Duct

No. 2318*—The manufacture and marketing of an improved, non-metallic, factory fabricated and packaged asbestos bonded duct has been announced. According to the maker, it is available in a complete range of sizes to cover both industrial and domestic uses, and requires only 10 per cent or less of the metal which would otherwise be needed.



Known as "Sal-Mo" supply duct, it is classified as fire retardant, it is stated.—Sall Mountain Co., 176 W. Adams St., Chicago, Ill.

Volume Control for Air Diffusers

No. 2319—A contract has been awarded for the installation of approximately 900 "Kno-Draft" air diffusers in the grand concourse of the new War Department building, which is said to be the largest building for office occupancy in the world. The diffusers, "Model F" supply units, are adjustable, permitting regulation of the angle of air throw, and contain an antismudge rim which tests, especially conducted in the interest of the particular job, proved to be effective.

An added feature of these diffusers is the new air volume control. Control of air delivery is made possible by a special damper installed in the neck of the unit, which may be raised or lowered to increase or decrease the air volume. The regulation is accomplished by means of an external knob in the center of the lower cone of the diffuser. Each diffuser within a common room or zone may thereby be set to deliver identical flow, or the vol-

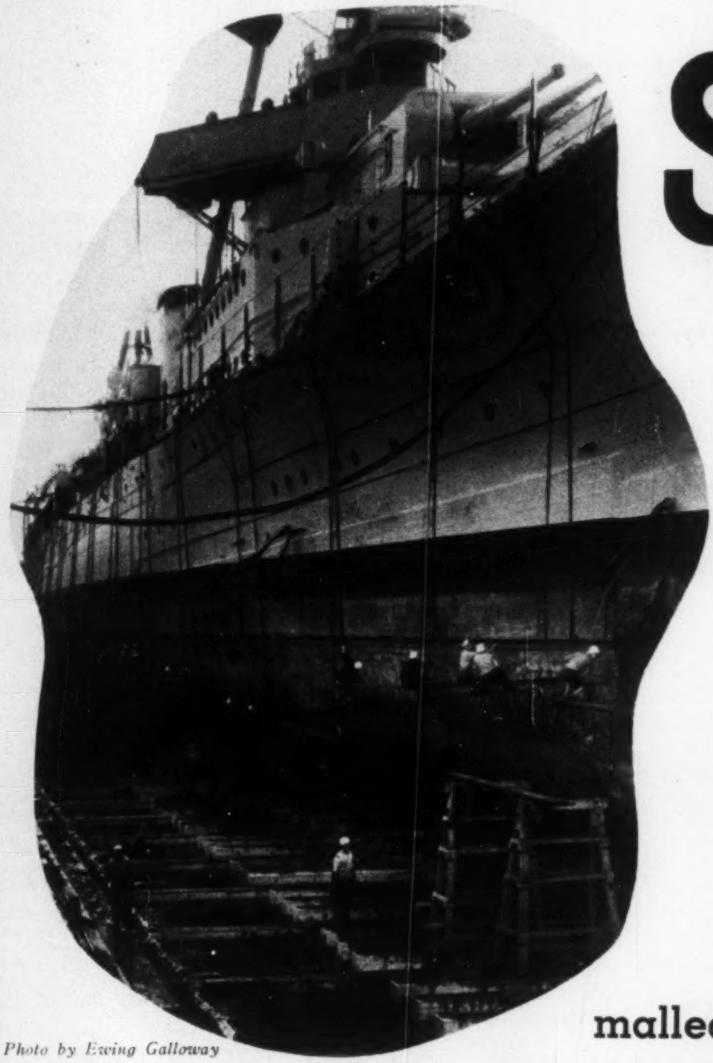


Photo by Ewing Galloway

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MIGHTY BATTLESHIPS . . . FAST DESTROYERS . . . SUBMARINES . . . TROOPSHIPS and FREIGHTERS all require malleable iron fittings. "MIF" malleable iron fittings are all made from air refined malleable thus assuring added safety to their important piping systems. The best is none to good for this all important service.

MIF

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SERVICE FOR FREEDOM

MALLEABLE IRON PIPE FITTINGS
BRANFORD BRASS SEAT UNIONS

MALLEABLE IRON FITTINGS CO., BRANFORD, CONN.

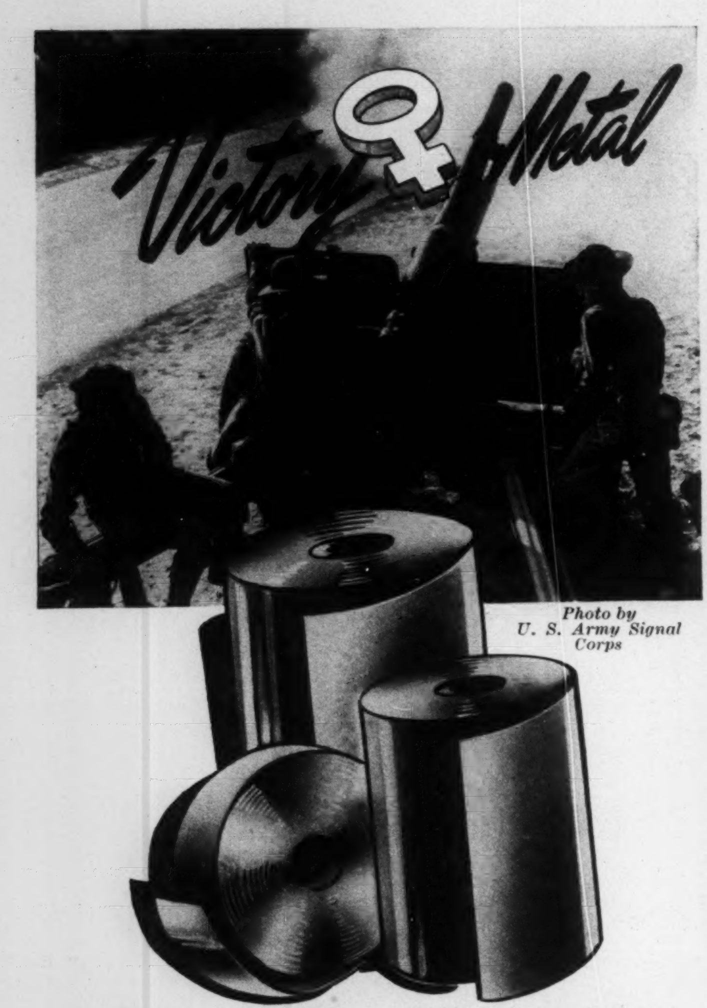

Photo by U. S. Army Signal Corps

HUSSEY COPPER

AN INDISPENSABLE ALLY IN WAR

The big guns depend on copper! Barrels wear longer, and accuracy is greater all because small copper bands on the projectiles reduce friction on the rifling . . . yet provide a tooth to mesh with the barrel rifles which set up the rotating action of the projectile that is so necessary to marksmanship.

Copper is serving Victory in ways that no other metal could serve; that's why Hussey Copper is literally fighting on every American front.

HUSSEY

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Warehouses in Principal Cities

ume of any one or more may be increased or decreased over others.

The consulting mechanical engineer for the building is Charles Leopold.—W. B. Connor Engineering Corp., Dorex Div., 114 E. 32nd St., New York, N. Y.

Sight Feed Bubbler

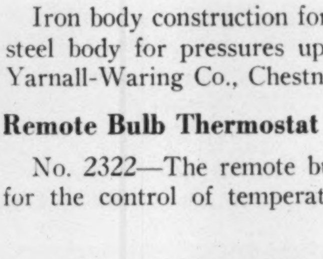
No. 2320—A sight feed bubbler has been developed for the continuous operation of tank liquid level gages. The unit has also been found to have even wider applications where a sight indicator is required, to purge lines, giving visible indication of gas flow, to note the presence of harmful or undesirable gases, and to use in conjunction with flow meters for the measurement of corrosive materials to eliminate the problem of satisfactory sealing fluids.

Two styles of bubblers are available depending upon the application, corrosive resistance necessary, and pressure requirements. Either unit can be furnished in brass or semi-steel construction with the bubbler bowl of pyrex glass or plastic. One is a ring type with the bowl fastened to the body by means of a packing ring held by six screws. The other is a strap type and has the bowl fastened in position by means of a clamping screw at the bottom of a swinging strap. The former has been designed for greatest unobstructed vision and the latter for convenient and quick removal of the bowl.

The rate of bubbling is adjusted by means of a stainless steel needle valve; all air or gas passes the valve before entering the bubbler tube inside the bowl.—The Meriam Co., 1955 W. 112th St., Cleveland, Ohio.

Fine Screen Strainer

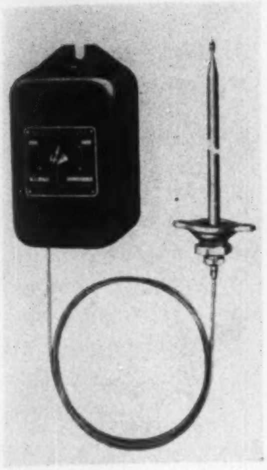
No. 2321—Available in six standard sizes, ½ to 2 in., a fine screen strainer has three improved features, says the maker, as follows: (1) Plating inside and outside for protection against rusting; (2) special "Monel" woven wire screen fine enough for straining service but having ample free area; and (3) straight thread and machined face on blowoff bushing for easy removal and replacement of the screen and for a tight joint.



Iron body construction for pressures up to 250 psi and steel body for pressures up to 600 psi are available.—Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.

Remote Bulb Thermostat

No. 2322—The remote bulb "Microtherm" is offered for the control of temperatures in ducts, tanks, liquid

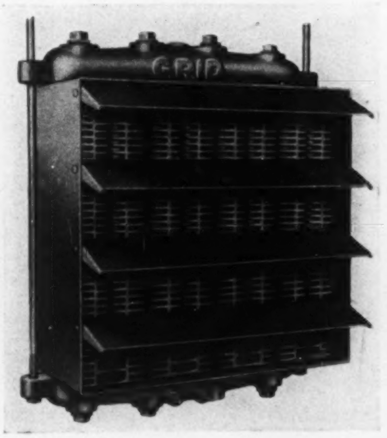


lines, dryers, cooking kettles, and similar applications.

It is a liquid filled remote bulb proportioning thermostat. This type instrument is used when it is desirable to mount the mechanism where it is readily accessible, free from vibration, dust, dirt, and extreme temperatures, says the maker.

These thermostats are available with or without armored tubing. — Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Cast Iron Unit Heater



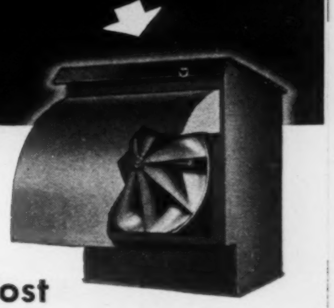
No. 2323—To cooperate with the war effort by using substitute materials the "Grid" unit heater is now being made with cast iron heating sections instead of aluminum heating sections. It is engineered and constructed to withstand up to 250 psi steam pressure.

The War Production Board has permitted the use of cast iron in this new unit as a substitute for cast aluminum. Being constructed of cast iron this new unit is free from electrolysis that causes corrosion, leaks and breakdowns, as only one type metal comes into contact with steam or hot water, says the manufacturer.—D. J. Murray Mfg. Co., Wausau, Wis.

Three Way Magnetic Valves

No. 2324—Redesigned three way magnetic valves which include both larger iron pipe sizes and port sizes, designated as "Series W-3-3, -4, -5," are capable of handling oil, water, air, gas, steam, refrigerants, and similar fluids and vapors not corrosive to valve material up to 400 F with IPS sizes up to 1 in. and port sizes to 15/32 in., the manufacturer states.

Being of the single magnetic type, the valve cannot assume an intermediate position, i. e., when port 1 is open to the flow, port 2 is closed when current is on; when current is off, port 2 is open to the flow and port 1 is closed. Valve construction is such

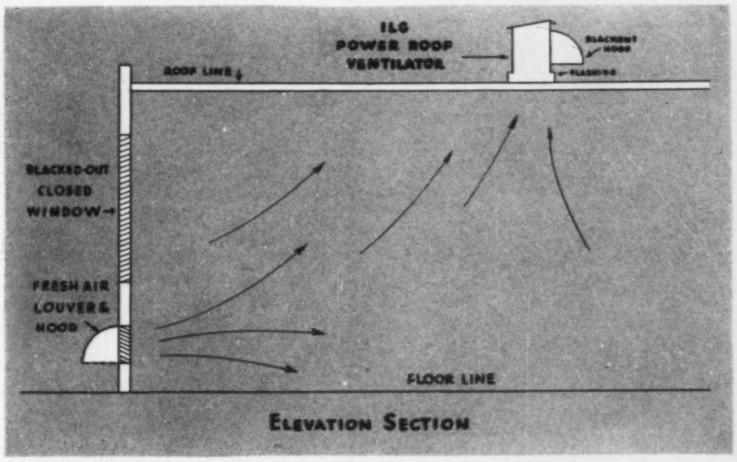


How to Engineer

Simple, Effective, Low-Cost

BLACKOUT VENTILATION

As windows are blacked-out and closed in war-crowded plants and offices, adequate ventilation becomes a *"must"!* Excessive heat, "worn-out" air, odors, smoke, steam, dust, fumes, etc., *must* be rapidly removed . . . fresh, invigorating air *must* be supplied to speeding workers . . . without transmitting light! To help you solve this modern problem, Ilg has developed the simple, effective, low-cost system illustrated below which not only handles emergency ventilation today, but will be in operation long years hence for normal air change requirements.



FREE . . . BLACKOUT BULLETIN!

New Bulletin No. 304 gives you the complete story . . . get it today. If you are faced with a specific job right now, write, wire or phone for dimension drawings on blackout hoods (to be quickly, easily fabricated on location) for standard Ilg Power Roof Ventilators, also Fresh Air Inlets.

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OFFICES IN 40 PRINCIPAL CITIES — CONSULT YOUR PHONE DIRECTORY

ILG

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AND AIR CONDITIONING

AIR CHANGE . . . NOT JUST AIR MOVEMENT!

that if reverse action is desired it is only necessary to change 1 and 2 connections.—General Controls Co., 801 Allen Ave., Glendale, Calif.

Sheet Metal Substitute

No. 2325**—A new sheet metal substitute for galvanized iron and sheet copper, known as "Protected Metal," conforms to the specifications of the Navy, Army, Coast Guard and other government departments, according to the manufacturer. It comes in sheet form, can be sheared, bent in a hand brake, bent on dies and run through a lock forming machine.

It contains neither coal tar nor asphalt and the finished coating is a very tough, elastic, rubber-like material which will not run at 230 F or crack at freezing temperatures. It will stand up under the baking rays of the sun and can be used with success when formed into ducts for warm air heating, it is stated.—Cheney Metal Products Co., 33 Oxford St., Trenton, N. J.

Plug Valves

No. 2326—A new line of "Lever-Seald" plug valves for 150 psi working pressure has been announced. Face to face dimensions of each valve are the same as those of the corresponding size of wedge gate valves. Thus, they are instantly interchangeable with wedge gate valves, without piping changes.

Other features include quarter turn operation, and a powerful leverage to provide positive, easy opening or shutoff under all conditions, says the maker.

Sizes range from 1½ to 10 in., in either semi-steel or steel.—Homestead Valve Mfg. Co., P. O. Box 348, Coraopolis, Pa.

Electric Air Cleaner Parts

No. 2327—The magazine Aero Digest recently an nounced that its prize for the best wartime productio short cut disclosed in the month of July has been awarde to Vincent L. Greth, manufacturing engineer.

He discovered a way to increase production of electri air cleaner parts. Faced with the problem of removin steel plates from a punch press quickly and withou scratching their surfaces, Mr. Greth drilled a hole in th center of a top die of the punch press and piped compressed air to the hold. Every time the press opens afte punching a ridge in the edges of the steel plate, the plat rides up with the top die. Compressed air, automatically turned on as the press starts to open, creates a lifting force on the plate.

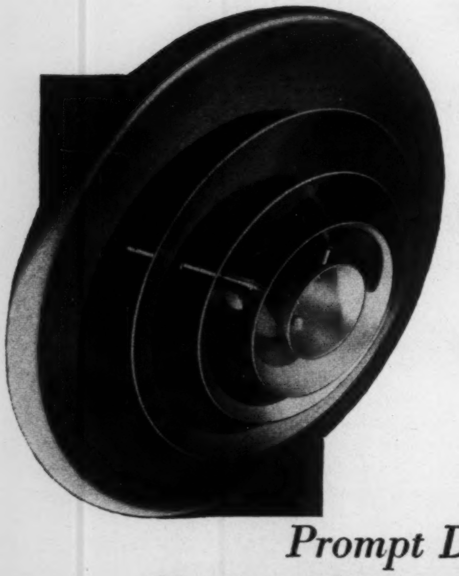
Once the press is open, the compressed air is automatically turned off and the plate drops safely into th hands of the press operator. Formerly the plates had to be pried loose from the bottom die of the press.

By increasing production of these steel plates fron 585 to 1000 an hour, the new method has hastened th delivery of thousands of electric air cleaners to arsenals, Navy laboratories and defense factories.—Westinghouse Electric & Mfg. Co., Cleveland, Ohio.

Steam Pipe Selector

No. 2328—A new pipe selector for steam is an inexpensive device which has been designed to eliminate th need for formulas and other lengthy methods of calculating pipe sizes for a given steam load. It comprises

The ANEMOSTAT



Provides
Draftless Air Distribution
Permitting
High Velocities . . Large Temperature Differentials
Resulting in
Minimum size Ducts and Equipment-Reduced Operating Expenses
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Competent Service by Competent Engineers located throughout the country To render service before and after installation.

Prompt Deliveries on Priority Orders
No air conditioning system is better than its air distribution

Anemostat Corporation of America
10 East 39th Street *everywhere, and* New York, N. Y.

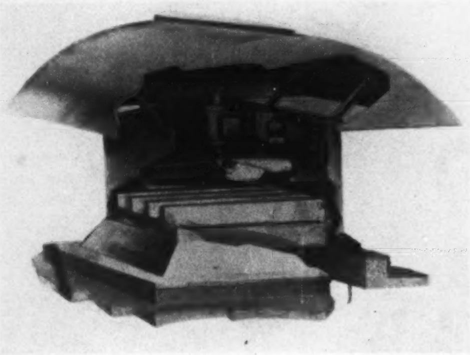
a circular chart, made of cardboard, with a revolving center scale.

All instructions for use are given on the selector.—E. S. Atkinson Co., 1115 Sassafras St., Erie, Pa.

War Plant Ventilators

No. 2329—A new series of war plant ventilators for blackout and other factory buildings has been announced.

Designed to prevent transmission and reflection of illumination from the building interior or the reflection of light from the night sky, these ventilators are available in three types, as follows: (1) Exhaust ventilators, to remove hot, humid air from the plant, exhausting it at the roof; (2) supply ventilators, to replace the excessively hot plant air with relatively cooler air from outdoors, drawing the air in at the roof and supplying it with uniform circulation to the working areas; (3) tempering ventilators, which warm and deliver air to the plant, drawing the air in at the roof and providing the needed ventilation with tempered air to prevent drafts and cold spots in the plant during cold weather.



Each of the types described comes in three standard capacities—10,000, 15,000, and 20,000 cfm. The units may be used singly or in multiple.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Odor Control for Air Discharge

No. 2330—The Dominion of Canada agriculture department recently brought a scientific development to the aid of livestock handlers when it installed "Dorex" odor control at a hog testing station. Residents had complained of the odors resulting from the presence in the station of about 200 hogs, because the discharge from the ventilating system polluted the surrounding air.

The odor control unit illustrated was erected on the floor of the loft, and air exhausted from the building passes through it. Specifications called for the use of wood and insulating board instead of metal for the casing. The walls and floor of the unit are made up of two ½ in. thicknesses of plywood, with two ½ in. thicknesses of insulating board between, with roofing felt separating the insulating board from the plywood. Due to the fact that the shaft is about 3 ft 6 in. square, and the unit is about 6 ft wide, the filters were set back from the shaft to allow a straight air passage. The unit employs 144 canisters at present, with space on the manifold plate for an extra 36 canisters to take care of a possible later increase in capacity. The exhaust fan pulls in the neighborhood of 4000 cfm or a little more, and will handle 5000 cfm with the extra canisters installed. The

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Natural Draft Cooling
Rotojet Spray Nozzles
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Outdoor Installations

BINKS cooling towers are designed to cut down water bills and reduce operating costs of modern air conditioning equipment. Each tower is tailor made for the particular job in hand. The towers are light in weight, adaptable to small areas and quiet in operation. BINKS ROTOJET spray nozzles break the water into an exceptionally fine mist for maximum cooling. Drift moisture is reduced to a negligible factor. In BINKS cooling towers both the first cost and operating costs are low. BINKS cooling towers are made in all sizes and types—forced draft or natural draft—for use indoors or outdoors.

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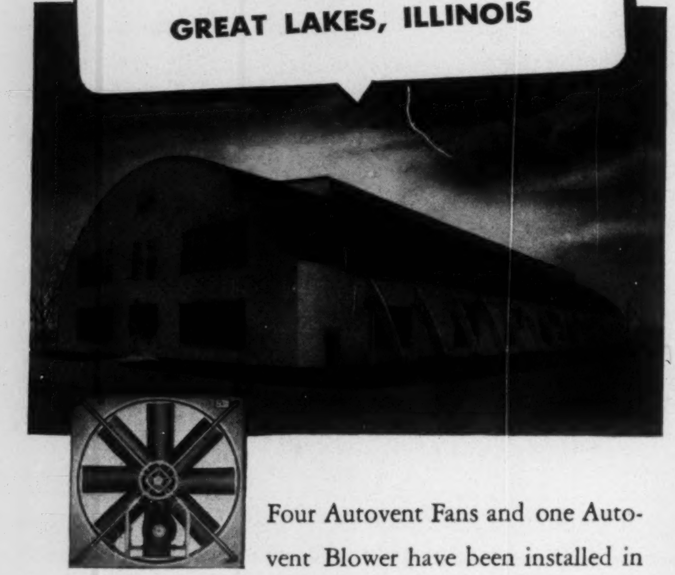
AT NINTH NAVAL DISTRICT
HEADQUARTERS,
GREAT LAKES, ILLINOIS



Four Autovent Fans and one Autovent Blower have been installed in Drill Hall "X" at the Ninth Naval District Headquarters, Great Lakes, Illinois. During the past 10 months, 85 Autovent Fans and 41 Autovent Blowers have been installed at this Naval Training Station.

Many other vital Defense Projects in all sections of the country are ventilated by Autovent Fans and Blowers.

Autovent also manufactures a complete line of quality fans and blowers for industrial, commercial and public buildings. All Autovent Products are tested and rated in accordance with the Standard Test Code of the National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers.

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have also been installed at Air Bases, Naval Bases, Navy Yards, Arsenals, Ordnance Plants, Camps and Forts vital to our National Defense in this country and abroad. There are 263 models, sizes and arrangements, making it possible for you to select the exact unit to solve practically any heating problem most satisfactorily and economically.

Horizontal Shaft Propeller-Fan Type hiJet Heater

THE HERMAN NELSON CORPORATION
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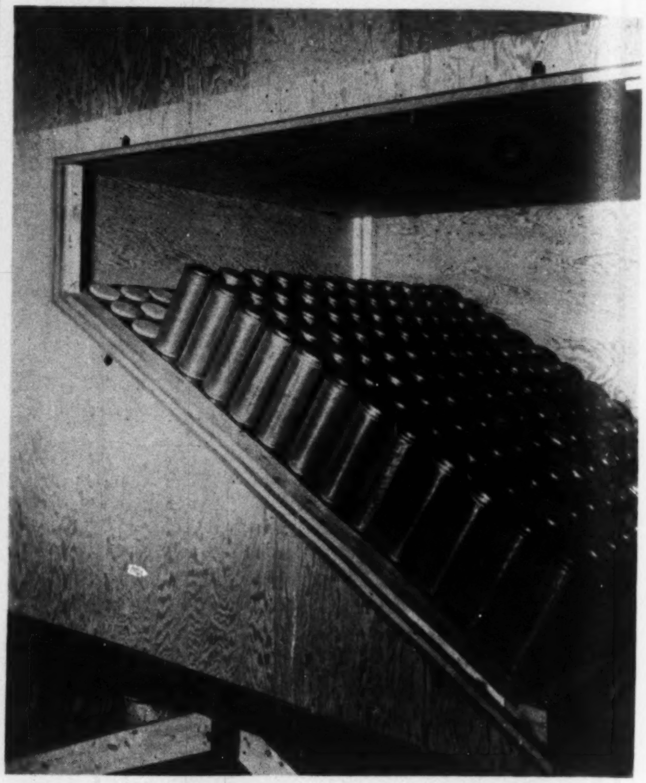
Manufacturers of Quality Heating, Ventilating and Air Conditioning Products

damper in the shaft, and a damper installed in the rear of the casing, are operated by means of ropes from the floor below.

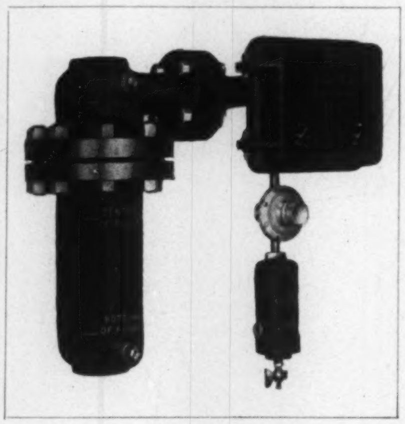
The unit is set on 2 by 4 bridging about 2 ft above the floor, so that the opening into the exhaust shaft will clear obstructions caused by the construction and connection of the horizontal exhaust shaft. The height of the space housing the air filters and canisters is 4 ft 5 in. The space immediately behind the canisters at the damper is 1 ft x 5 ft, and the rather large space housing the fan is necessitated by the fact that the shaft damper had to be placed fairly high in the shaft to avoid other structural difficulties.



The carbon within the canisters extracts the odors like a gigantic gas mask, and has eliminated the odor nuisance.—W. B. Connor Engineering Corp., Dorex Div., 114 E. 32nd St., New York, N. Y.

Improved Level Control

No. 2331—An improved displacement type "Level-Trol" that—says the maker—features greater sensitivity, speed of action, freedom from service trouble, and ease of adjustment has been announced. It is available in float cage or internal float type construction for handling all liquids at all pressures, temperatures, and specific gravities; it can be used for level control, interface level control, level indication, or specific gravity control.



Level position adjustment permits the positive controlling of level at any desired point within length of float, while the throttling range adjustment makes it possible to vary the amount of level change necessary to stroke the diaphragm valve. New design features include "Inconel" torque tube construction to eliminate stuffing box packing and lubrication. Torque tube is supported by stainless steel knife edge bearing. Small rotary shaft turns on precision ground ball bearing inside the pilot case.—Fisher Governor Co., 205 S. First Ave., Marshalltown, Iowa.

Asbestos Faced Board for Ducts

No. 2332—A new asbestos faced, laminated board has been developed for the fabrication of return ducts (and for other uses). According to the manufacturer, use of this board for ducts has received the approval of building commissioners in a number of large cities.

The board is white asbestos on both sides and is flameproofed, rustproof, moisture resistant and a nonconductor of electricity, it is stated. It requires no additional finish but takes cold water paints, or lead and oil after sizing.

The product comes in sheets 33 in. wide, and is called "A-D" board.—Philip Carey Mfg. Co., Wayne Ave., Lockland, Cincinnati, Ohio.

Gearing for Gages

No. 2333—A new and improved type of gearing in the form of a patent cam and roller movement has been developed for use in pressure indicating gages. The movement employs a sector shaped driving cam and a driven helical roller. One end of the pivoted cam is linked to the tip of the bourdon tube while the other end is aligned with and fits freely into the thread of the roller.

According to the manufacturer, this cam and roller movement provides smooth and constant transmission of motion from the bourdon tube to the pointer. As the edge of the cam is in constant contact with the wall of the helical thread, there is no lag or lost motion between these parts, it is stated.—Certified Gauge & Instrument Corp., Maytag Bldg., at 34th St., Long Island City, N. Y.

Welding and Brazing Fluxes

No. 2334*—A new line of welding fluxes for both ferrous and nonferrous metals has been announced.

No. 1 is a flux for welding cast iron. It floats to the surface the heavy oxides which form during welding and keeps them liquid so that a dense, nonporous and ductile weld can be produced. No. 2 is a cast iron brazing flux which produces a good bond at low base temperature and holds the bronze being applied at a uniform molten consistency. No. 3 brazing flux, suitable for brass, bronze, copper, steel, and malleable iron, is so compounded that it reduces atmospheric oxidation and keeps flux glaze at a minimum so that the bronze deposit remains clean and bright. Thorough tinning and cleaning is promoted through the ability of the flux to run well ahead of the weld puddle. No. 22 is an aluminum flux for sheet, cast, wrought, and alloys.—National Cylinder Gas Co., 205 W. Wacker Dr., Chicago, Ill.

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THE KRAMER Balance Loader SYSTEM (Patented) is a modulating refrigeration system capable of varying from 0% to 100% of full load, and maintaining a fixed minimum back pressure in the suction line and in the compressor crank case.

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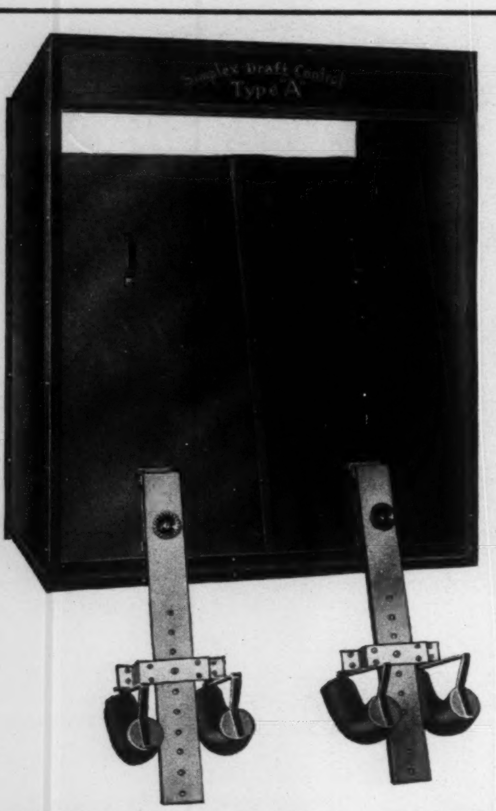

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The present emergency makes it of vital importance that extravagant operation of boiler plants be stopped in order to conserve fuel so necessary to the National Defense Program. The surest and quickest way to positive fuel economy is the installation of Simplex Automatic Draft Controls which deliver secondary air automatically to the stack breeching, thereby reducing, to the desired point, the draft pull on the boiler, naturally resulting in more perfect combustion.

Simplex Automatic Draft Controls also reduce the flow of hot gases through the boiler, reduce infiltration of air in the boiler setting, reduce the amount of "cold air inrush" which causes sudden shrinkage of all boiler parts and settings when the fire doors are opened. It eliminates hot spots in the coal bed, causing local hot spots in the boiler, and in oil and gas fires, it eliminates floating or pulsating flames and the "sucking out" of pilot lights, causes good ventilation in boiler room by diluting the stack gases with boiler room air. It will also improve feed-water regulation, allow even more superheat, reduce clinker trouble, lengthen the life of tubes and grates and reduce tube clogging due to high blast pressures through thin fires.

The adjustment of the Simplex Automatic Draft Control is worked out scientifically, but simply, and can be regulated to a point of very accurate performance.

These superior draft controls are the answer to the heat waste question in boiler rooms and it will pay you well to learn more about them. Further information on request, please write for it. Made for any size Industrial, Commercial or Domestic boiler plant.

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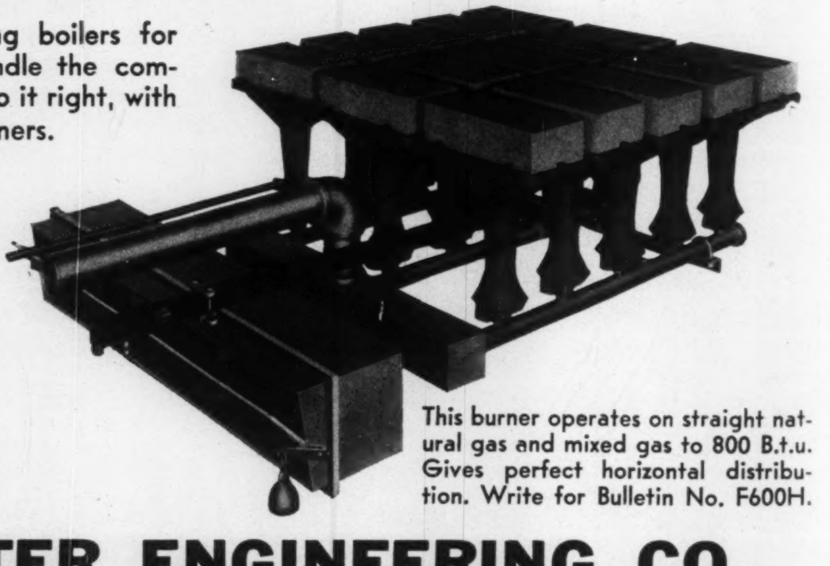
Our engineering department is thoroughly capable of helping you solve your burner problems and to design special equipment to meet special conditions.



This burner operates on straight natural gas and mixed gas to 800 B.t.u. Gives perfect horizontal distribution. Write for Bulletin No. F600H.

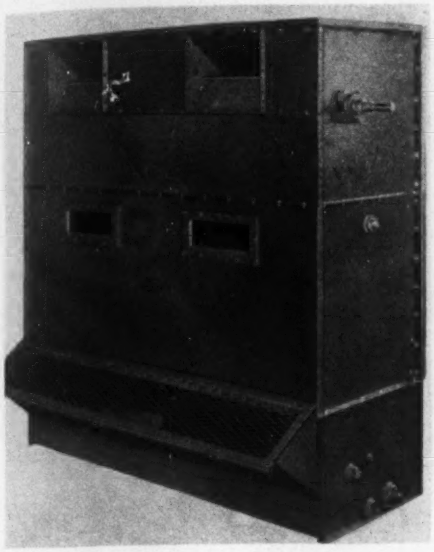
THE WEBSTER ENGINEERING CO.

TULSA, OKLAHOMA

Division of SURFACE COMBUSTION **TOLEDO, OHIO**

Evaporative Condensers

No. 2335—A new line of "Aquamisers" (evaporative condensers) with a complete range of sizes from 5 to 100 tons normal refrigeration capacity has been announced. They are used as condensers for "Freon" refrigeration compressors and also as process liquid coolers. Typical applications include jacket water cooling for diesel engines and air compressors, quenching oil cooling, and anode cooling.



These units consist of three major sections—fan, condenser, and sump. Individual sections are of size and weight to permit easy handling and erection. The casing is made of heavy, galvanized sheet steel and all parts are protected against corrosion and severe operating conditions.—Westinghouse Electric & Mfg. Co., Springfield, Mass.

Aneroid Manometer for Flow or Liquid Level

No. 2336—The absence of mercury or other liquid in this new device removes the possibility of product contamination and the hazard of mercury being blown due to line surges or carelessness, says the maker. Further advantages are that sealing liquids are rarely required and vital mercury is released for the war effort.

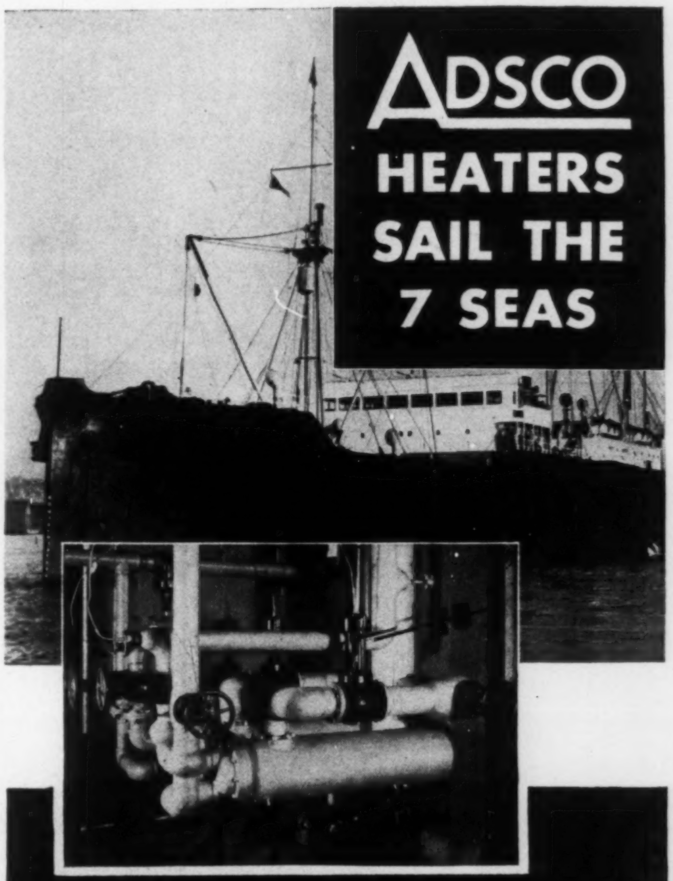
Replacing the stuffing box is a new torque tube assembly which gives a completely closed system and is designed to eliminate friction and lubrication. Metal bellows respond to the pressure variations and insure fast response under ordinary circumstances with immediate reaction to sudden changes in flow.

Under steady flow conditions this planometer is accurate within 1 per cent of scale range, according to the manufacturer. It is available for all types of indicating and recording meters and controllers and is supplied for standard ranges between 20 and 500 in. of water. The range can be changed on the job by substituting precalibrated torque tubes.—Taylor Instrument Companies, 95 Ames St., Rochester, N. Y.

Liquid Soldering Flux

No. 2337—"Special-X Industrial Concentrate" is the name of a new liquid soldering flux which is sold as a concentrate and can be used full strength or diluted to suit the job. According to the manufacturer, it will easily solder stainless steels, monel metal, alloy coppers, brasses, iron, zinc and "practically every metal and alloy except aluminum."

It is being used in the production of numerous items



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Making "UP-TO-DATE" Steam Line Equipment for over 60 years

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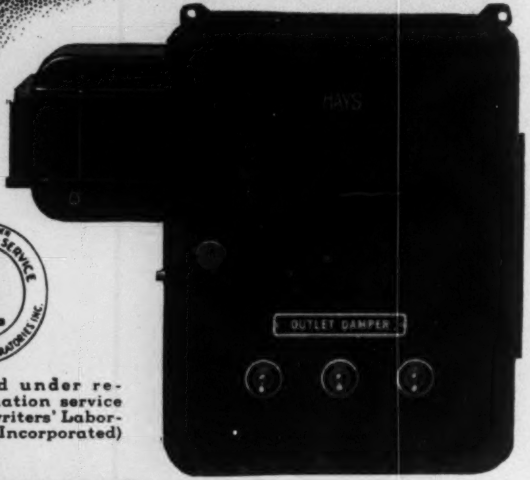
during "OFF" as well as "ON" periods in intermittent firing—POSITIVELY PREVENTS BLOW BACK!



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AN ingenious and practical device for automatically controlling combustion in the "on" and "off" type of installation—burning either oil or coal. In wide use in apartment houses, small industrials, commercial installations, green houses, etc. **With this controller the firing equipment cannot start until the stack damper is wide open.** This allows for internal expansion without starting puff when fire lights. In operation, the combustion chamber draft is regulated to a low and efficient value during the "off" period and at an efficient and economical value during the "on" period. You'll win friends and influence sales with the Hays Sequence Controller—a definite economy and safety factor.

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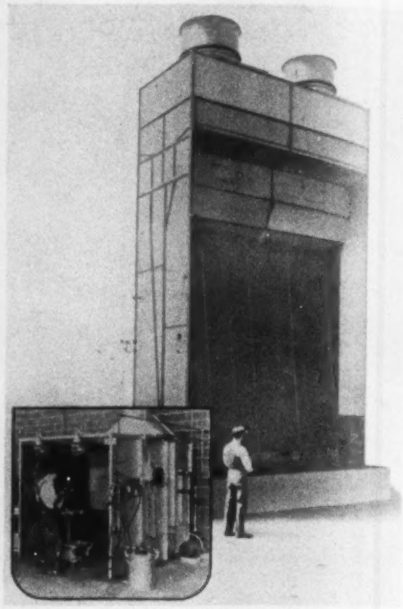
of war equipment, refrigeration expansion valves and motor controls.—Industrial Service Laboratories, 915 W. Oklahoma Ave., Milwaukee, Wis.

Big Spray Booth

No. 2338—Soon, in one of the big aircraft plants, the "world's largest" water wash spray booth will be in operation. It will be 152 ft long, 100 ft deep and 31 ft high and was designed and built for painting large bomber parts and complete planes.

The illustration shows one of the eight compartments, as compared to an ordinary industrial spray booth. These compartments will be assembled in pairs, side by side, with an intervening 6 ft space between pairs to accommodate motor driven accordion partitions—31 ft high and having a 100 ft span. Folding partitions are also mounted on the ends.



The booth's design has several advantages. Because of its sectional construction and folding partitions, it can be used as one enormous spray booth with 15,200 sq ft floor space or can be cut into two, three, or four booths, each large enough to accommodate a bomber's fuselage less its wing surfaces. The maximum booth space will permit a complete large size bomber to be wheeled in for painting.

The wash down curtain in each compartment is 20 ft high and water cascades over it at the rate of 24,000 gph. Air is drawn through the curtain of water in each compartment by two fans each 48 in. in diameter and each driven by a 7½ hp motor, developing a capacity of 31,000 cfm of air for each water wash compartment. This exhaust system assures the complete removal of spray vapors from all parts of the booth, even on the largest painting jobs.—The DeVilbiss Co., 300 Phillips Ave., Toledo, Ohio.

Fast Stabilizing Control

No. 2339—A development of importance in the field of control engineering has been announced under the name of "Hyper-Reset." This is not an instrument or a mechanism, but a control function, available in the newly-designed "Model 30 Stabilog" controller, for application where process lag is considerable. Its importance is demonstrated by tests in which the reset consistently re-established process stabilization, following an upset, in one-quarter of the time, and with only one-half the upset effect, as compared with a similar controller having only the usual reset, according to the manufacturer.

The method reduces the effects of a process disturbance by making initial temporary additional corrections, which are proportional to the rates of change of the measured value caused by the disturbance. The normal reset follows, establishing stabilization. But the several control functions carried out are simultaneously and automatically adjusted. No tuning-in is necessary.—Foxboro Co., 106 Neponset Ave., Foxboro, Mass.

Air Cooled Arc Welder

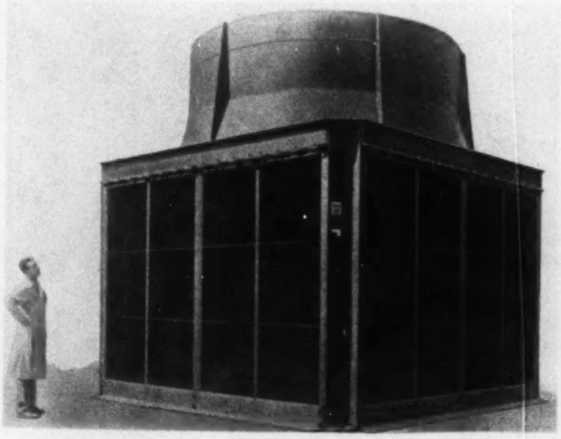
No. 2340—To meet the war need for continuous high duty mass production welding, a new, heavy duty, air cooled arc welder, known as the "250 F," has been developed. The new machine contains a builtin cooling system, and is heavier all around than its sister model.

The wartime demand for virtually continuous welding prompted the development of this machine. Its makers point out that under normal conditions, naturally cooled welders get a chance to cool down, while their operators change rods, remove slag, and position work. Today, however, the active duty cycle is at a peak. The welder merely changes rods, his assistants perform the other operations. Consequently, the welding machine is in almost constant use at a high duty cycle and unless it is provided with cooling equipment the above-normal temperatures will cause it to lag and eventually burn out.—Ergolyte Mfg. Co., 3644 Lawrence St., Philadelphia, Pa.

Engine Cooling Equipment

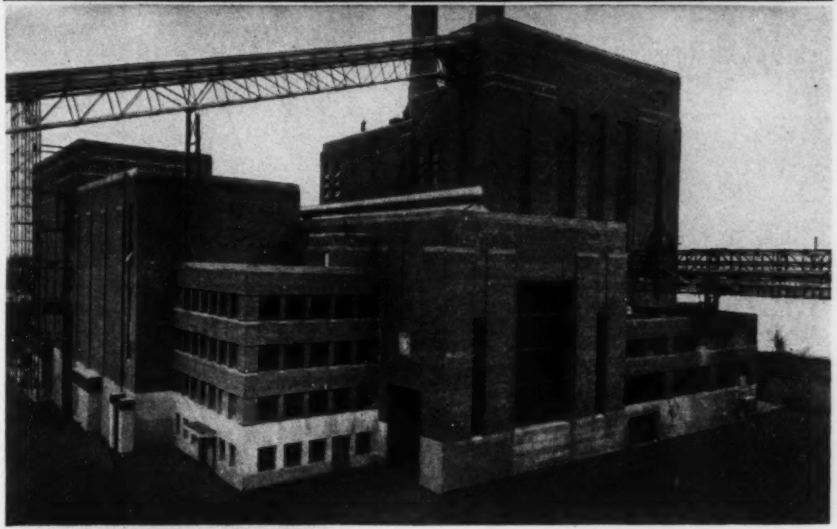
No. 2341—To meet expanding engine ratings and increasing efficiency of engines, a number of developments have recently been made in the design of large engine cooling equipment. Among them is a new "Quad" atmospheric cooling tower, a unit about 14 ft high and measuring about 12 ft square at its base. It supplements the manufacturer's line of engine jacket water coolers.

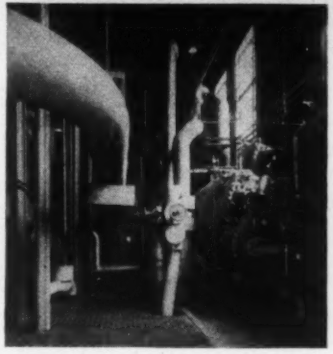
This cooler is formed into a four sided assembly, the sides of which are comprised of heat transfer surface for water, oil or gas cooling, or for steam and vapor condensing. An induced draft fan is mounted in a horizontal plane above the cooler, drawing air through the heat transfer elements and discharging it upward through an aerodynamically designed stack.



According to the manufacturer, by concentrating a great amount of effective cooling surface into a cubical form, it is possible not only to provide unit cooling capacity equal to the requirements of any internal combustion engine or compressor, but also to eliminate the serious defects caused by cross-wind currents.

RU-BER-OID Insulations help make more power for war industries





(Top) Exterior of Union Electric Company's new power plant. (Above) Interior view showing RU-BER-OID Insulations. Various types were used to gain efficiency. General Contractors and Engineers: Stone & Webster, Inc. Insulation Contractor: The St. Louis Insulation Co.

Growing war industries demand more and more *dependable* low-cost power. Old, and new, power plants must maintain high efficiency, with minimum breaks in transmission.

RU-BER-OID Insulations today serve many power plants, help keep kilowatt loads up, reduce power losses, save fuel. One of the newest super-power plants using RU-BER-OID Insulations is that of the Union Electric Company of Illinois supplying power to the rapidly expanding war industries in the St. Louis area. Many types of insulation were needed on this job and Ruberoid with its complete line was selected.

To meet your specifications RU-BER-OID offers a complete line of insulation materials including: 85% Magnesia and Hi-Temp Insulation in pipe covering and block form; Rock Wool Insulations and Insulating Cements. This means that the proper type of insulation can be chosen to meet each specific problem.

You should have at your fingertips the facts about the complete line of RU-BER-OID Insulations—how you can custom-build each job. Ruberoid's Insulation Guide will *give* you these facts, tell you at a glance.

MATERIALS, MEN and METHODS . . .

All three contribute to insulation efficiency. The Ruberoid Co. offers you all three to custom-build each insulation job. Should any Ruberoid insulation product be temporarily withdrawn from the market, or priority orders make deliveries long delayed, Ruberoid will suggest other insulating materials—that may be substituted without the loss of efficiency.

RU-BER-OID
INSULATION
GUIDE

Send for this FREE Insulation Guide

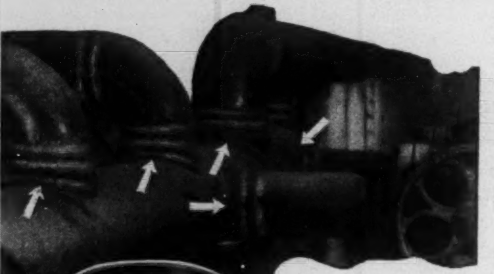
Handy, factual, complete with charts and tables. We urge you to send for your copy of this valuable Insulation Guide *now.* Address Dept. HPC-9, The Ruberoid Co., 500 Fifth Avenue, New York, N. Y.

RU-BER-OID *Insulation*

For HEATING · COOLING · AIR CONDITIONING

WELDOLETS·
TRADE MARKS REG. U.S. PAT. OFF.
THREDOLETS
. . . Welded Outlets for Piping . . .

How to cut the cost of right-angle branch pipe outlets



THE most costly part of any piping installation is the labor and materials required to make branch pipe outlets. Bonney WeldOlets, ThredOlets and Socket-End WeldOlets will keep that cost to a minimum.

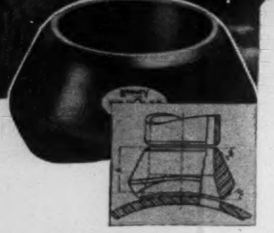
Using these fittings, installing them either by electric-arc or oxy-acetylene welding will reduce the cost of right-angle branch pipe outlets from 10 to 35% when compared to the cost of making similar outlets with threaded tees or pipe-to-pipe intersection welds.

Bonney WeldOlets, ThredOlets and Socket-End WeldOlets provide other advantages impossible to obtain by using other methods to make similar types of outlets. Because they are installed by welding, they eliminate all cutting, threading or fitting of the main pipe. Because of their patented design they provide an outlet of full pipe strength that is absolutely leakproof and which, because of its funnel-shaped intake aperture, reduces friction and turbulence to a minimum.

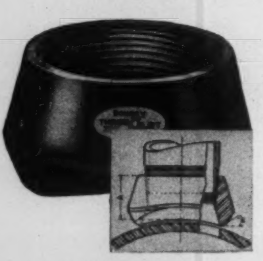
WeldOlets, ThredOlets and Socket-End WeldOlets eliminate the necessity for templets and preliminary layout of the main and branch lines. The fitting itself is used as a templet.

Standard stock fittings (outlets from 1/4" to 12") in size-to-size and reducing sizes are drop forged steel. For special applications, or where unusual conditions exist, they can be supplied in Toncan Iron, wrought iron, brass, Monel, Everdur, etc. and in sizes up to 24" x 24". WeldOlets, ThredOlets and Socket-End WeldOlets are suitable for every type of piping installation and for all commonly used pressures and temperatures.

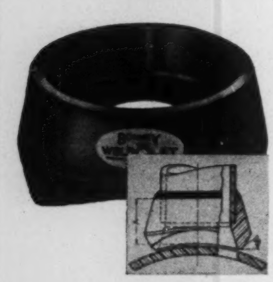
Your local distributor will be glad to tell you the complete story about savings which can be effected—or, write for Bulletin WT31—TODAY.



WELDOLET

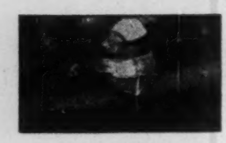


THREDOLET



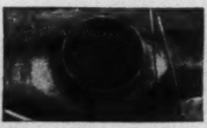
Socket-End WELDOLET

EASILY INSTALLED

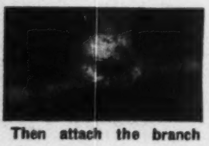


Mark center lines and tack the fitting into place.

Then weld the fitting to the main pipe.



Remove the button, which will also permit inspection of the inside of the joint.



Then attach the branch pipe.

BONNEY
WELDOLETS
THREDOLETS

Bulletin WT31—just off the press—a 16 page catalog covering every feature of these fittings in complete detail and showing many of the various types of installations on which they have been made.

BONNEY FORGE & TOOL WORKS
FORGED FITTINGS DIVISION
ALLENTOWN, PA.

A condensing capacity of 15,600 lb per hr of steam can be provided within a single cooler.—Young Radiator Co., 709 Mead St., Racine, Wis.

Clean Air Guards War Production

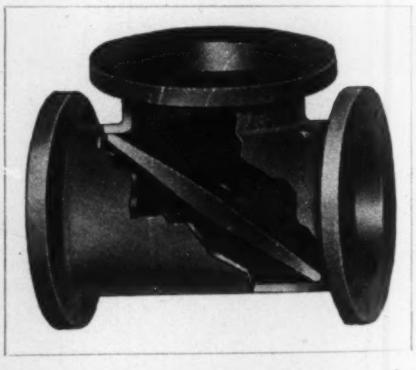
No. 2342—Assisting in the manufacture of bombsights, Army binoculars, tanks, and guns, and in the preparation of blood plasma, are "Precipitrons" to clean the air, according to George F. Begoon, manager of the maker's "Precipitron" division.

In 16 naval air stations, these units are supplying clean air to the rooms where bombsights are overhauled and repaired. All dust must be kept out of the optical systems of bombsights if they are to maintain great accuracy. The air cleaners are also used in eight plants producing Army binoculars, range finders and submarine periscopes. Clean air in these factories prevents the collection of dust on precision lenses during assembly.

Fifteen hundred air cleaner cells will soon be at work in a naval ordnance plant where bombsights are manufactured, to supply 900,000 cfm of air. In an arsenal, they are banishing dust from rooms in which delicate optical instruments, bombsights and anti-aircraft ammunition are manufactured. In another, where parts of Army tank bodies are welded together, a unit removes welding fumes from the factory air to protect the health of workers. In a third arsenal, a unit keeps dirt off the delicate polished surfaces of precision gages.—Westinghouse Electric & Mfg. Co., Cleveland, Ohio.

Three Way Butterfly Valve

No. 2343—Unusually quick action is provided in a three way valve of the butterfly type, according to a recent statement of the manufacturers. It is designed for mixing and quick interchange service and adapted to fully automatic control by means of an air diaphragm motor or hydraulic cylinder.

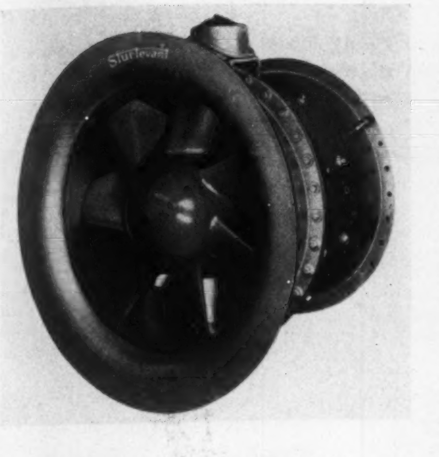


The valve is constructed of cast steel or cast iron for pressures up to 600 psi. When desirable, special metals for resistance against heat, abrasion, and corrosion can be substituted. A special feature is the self cleaning, double beveled, streamlined vane. It seats wedge tight against the body of the valve, thus producing a tight shutoff as well as positive control of volume and pressure, it is said.

For inaccessible locations, a reach rod with de-clutching unit is provided for automatic operation or manual control in case of power failure.—R-S Products Corp., Germantown Ave., at Wayne Junction, Philadelphia, Pa.

Axial Flow Fan

No. 2344—An innovation in axial flow fan design has recently been announced. Bearing the name "Victory Axiflo," it possesses outstanding features in perform-

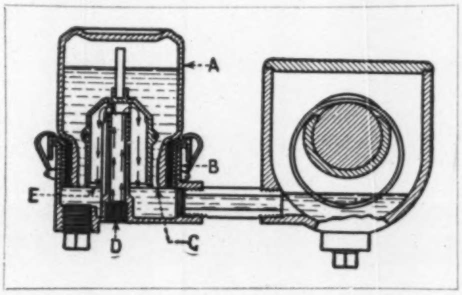


ance, quiet operation and savings in weight, space and power, the maker states.

For the duration of the war the use of this fan must be restricted to the U. S. Navy, where it is now being used for heating, ventilating and mechanical draft service on battleships, cruisers, destroyers, and airplane carriers. At the conclusion of the emergency, it will be available to industry.—B. F. Sturtevant Co., Damon St., Hyde Park, Boston, Mass.

Constant Level Lubricator

No. 2345—A new constant level lubricator holds a visible reserve supply of oil and releases automatically just as much as is needed to maintain a constant predetermined level of lubricant. According to the manufacturer, it assures adequate lubrication at all times, prevents oil waste, and avoids deterioration or spoilage of material caused by oil throw. It was designed for electric motors, pillow blocks, pumps, air conditioning equipment, fans, gear boxes, textile and paper making machinery, etc., and is available in four standard sizes with capacities of 2, 4, 8 and 16 oz. The accompanying diagram illustrates the principle of operation.



When the reservoir *A* is filled and inverted into position on the base *B*, the lower edge *E* of the inverted bucket or bell determines the oil level which the lubricator will maintain. When the level falls below this point, air from the vent *D* escapes under the side of the bell, as at *C*, up to the top of the lubricator, permitting oil to flow down until the level to be maintained again seals across the base of the bell.—Oil Rite Corp., 3466 S. 13th St., Milwaukee, Wis.

Thermostatically Controlled Diffuser

No. 2346—The thermostatically controlled "Venturi-Flo" meets the need for overhead type air diffusers in year 'round air conditioned spaces with high ceilings. The higher the mounting height, and the wider the spread between the temperatures of the supply air for cooling and the supply air for heating, the greater the need becomes for a dual purpose diffuser, says the manufacturer, who states that these diffusers are ideal for combined heating and cooling installations which require that the outlet be mounted on the order of 25 ft or more from the floor.

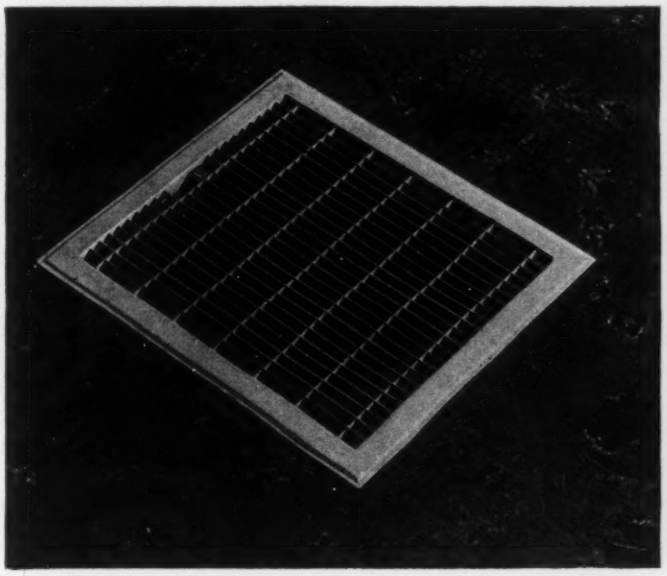


Fig. DR—DuraBilt Register

DURABILT
Floor Registers and
Cold Air Faces

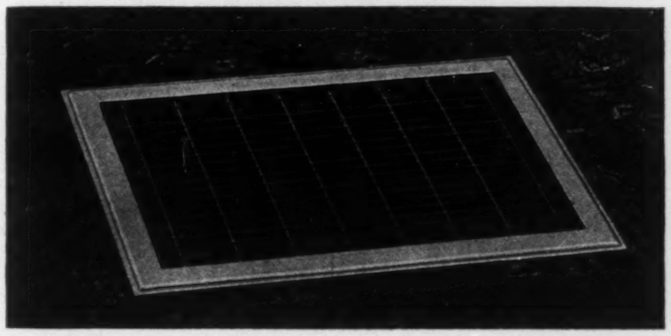
Extra service is built into the sturdy DuraBilt Model—yet it is priced within the cost restrictions of the small-home market. These registers and intakes are accurately assembled with heavy flat steel bars, mortised and interlocked at every cross-joint. This grille assembly is tenoned and locked tightly into welded and reinforced frame, making a highly rigid and durable construction. Open area is 81%. Furnished in narrow mesh as standard for all sizes. The 7/16" by 1-15/16" opening is heel-proof, excludes small objects such as chair legs, and tends to conceal the register box interior. For structural strength—use DuraBilt Registers and Intakes.

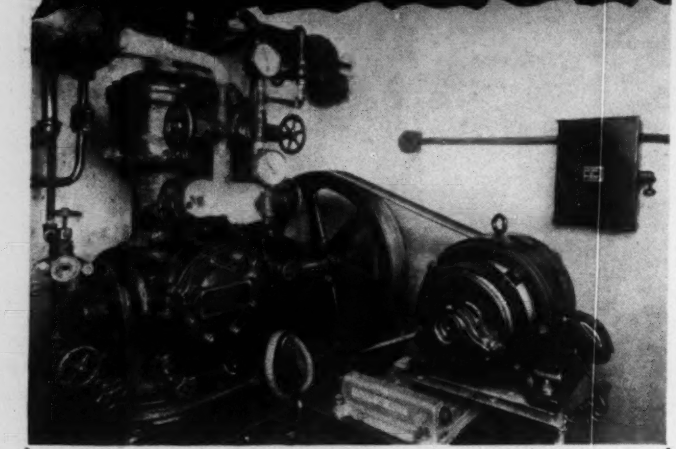
Write for complete Auer Register Book 41 showing all models for air conditioning and warm air systems. Special Grille Catalog "G" also sent on request.

The Auer Register Co. 3608 Payne Ave., Cleveland, O.

AUER
REGISTERS
& GRILLES
For Air Conditioning *and* Gravity

Fig. DSC—DuraBilt Cold Air Face





Long Service Low Maintenance

with TANNATE-ROCKWOOD—the air-conditioning drive that AUTOMATICALLY MAINTAINS CORRECT BELT TENSION:

If the load varies, the weight of the motor on the pivoted Rockwood base automatically adjusts the belt tension. The Tannate leather belt grips tightly, evenly; transmits maximum power; maintains constant speed with little or no attention other than an occasional application of Rhoads Belt Preserver.

Even when exposed to moisture and machine oils, Tannate leather belting has plenty of stamina to withstand continuous operation, endures for years and years without appreciable loss of efficiency.

ESTABLISHED 1702
J. E. RHOADS & SONS
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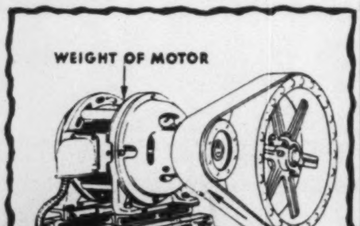
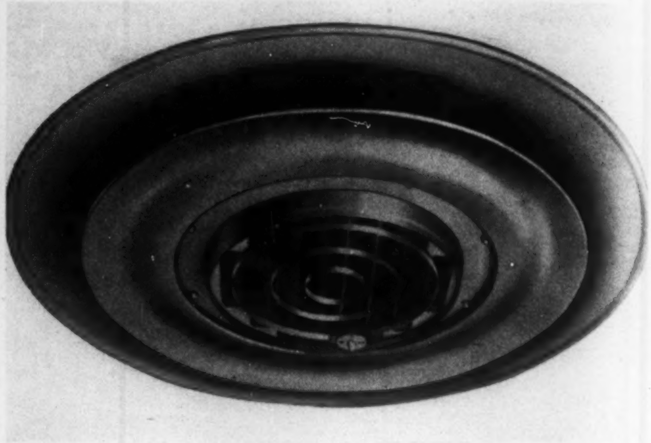


RHOADS
Tannate-Rockwood
The ideal
SHORT CENTER DRIVE

They have automatically controlled directional air fl and are capable of handling quietly and efficiently, supp air, the temperature of which may be required to va over a wide range in order to balance load requiremen

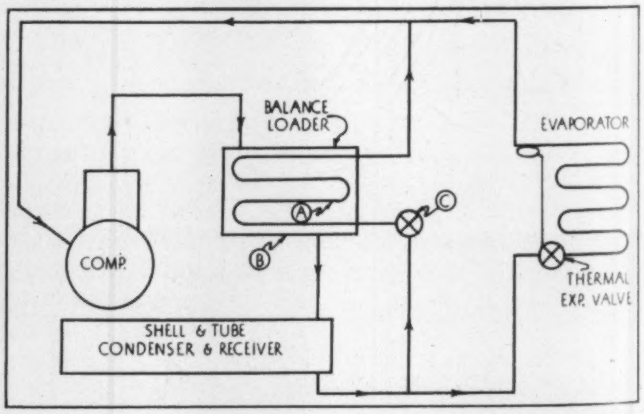
A thermostat in the supply duct controls the blades i a multivane damper on the underside of the unit. F cool air, the damper is closed, and all of the air is diffused in a conical pattern which covers the floor area th diffuser is designed to serve. When the air is at ventilating temperature, the damper assumes an intermediate position, thereby forcing part of the air toward the floor. One thermostat in the fan system will control a number of diffuser units. To overcome the natural tendency of warm air to rise, the dampers are fully open and the main body of supply air is forced directly downward toward the floor for heating. — Barber - Colman Co., 225 Loomis St., Rockford, Ill.



Modulating Refrigeration Control

No. 2347—A patented method of achieving modulating control of air conditioning and refrigeration systems is capable of varying from zero to 100 per cent of full load, maintaining a fixed minimum back pressure in the suction line and in the compressor crankcase, says the manufacturer, who points out that this method will automatically compensate for varying evaporator loads, giving a straight line capacity modulation.

Referring to the diagram, the balance loader is fundamentally a heat exchanger consisting of a direct expansion coil, *A,* within a cylinder shell, *B.* The expansion coil is controlled by an automatic expansion valve, *C,* set to open at a predetermined pressure. The hot gas from the compressor is passed through the shell of the loader before going to the main condenser.



As the heat load at the evaporator is reduced, the resulting reduction in suction pressure opens the constant pressure valve at the balance loader, which will automatically maintain the suction pressure at a constant predetermined level. Incidentally, the liquid refrigerant evaporating in the loader will pick up heat from the surrounding hot gas, thus acting as a booster condenser to the main condenser.

This system may be applied with a multiple compressor or cylinder bypass arrangement. In such cases, a balance loader of capacity sufficient to smooth out the operating conditions between steps is selected.

Among the advantages achieved by this means are constant back pressure, elimination of lubricating and seal troubles due to unusually low crankcase pressure, prevention of icing of air conditioning coils, partial flooding of the evaporator is permitted, and close control is achieved.—Kramer Trenton Co., 626 Brunswick Ave., Trenton, N. J.

[Add the new products and companies listed in Equipment Developments to the Directory Section which you received in your January, 1942, Heating, Piping & Air Conditioning *and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk indicates equipment and manufacturer not listed.]*

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 125. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Air Conditioning for War

No. 4250—Issue of "Airtemp News" with information on war products, including partial list of air conditioning installations for war uses. Such applications include control towers, ordnance manufacturing, hospitals, air fields, telephone exchanges, photographic laboratories, parachute cord testing, laboratories, process work, Army and Navy drafting rooms, Navy engineering, lens polishing, Army engineering, gage rooms, first aid stations, interceptor command information centers, constant temperature test rooms, Link trainer rooms, etc.—Airtemp, Div. of Chrysler Corp., Leo St., Dayton, Ohio.

Combustion Instruments

No. 4251—2 p. reprint describing various instruments, including automatic combustion control, draft gages, portable combustion testing instruments, combustion meters, orsats, draft controllers, etc.—Hays Corp., E. 8th St., Michigan City, Ind.

Engine Jacket Water Coolers

No. 4252—4 p. bulletin (13638) and 2 p. supplementary bulletins on engine jacket water coolers for gas, gasoline, and diesel engines, and compressor units, describing construction and giving capacity tables, curves, and dimensions. Also a leaflet on an engine cooling system cleaner and rust preventive.—Young Radiator Co., 709 Mead St., Racine, Wis.

THE MOST HONORED UNIT HEATERS ARE REZNOR

Selected for 165 Training Stations To Meet 3 Vital Requirements . . .

The circumstances surrounding the selection of Reznor Unit Heaters for 165 camps are important. Groups of able engineers, architects, and contractors in charge of construction of Army and Navy stations, selected the make of heaters they preferred for their own projects. The decisions were supported by their broad experience and technical heating education. The fact that practically all of these well qualified groups preferred Reznor Gas Fired Suspended Unit Heaters certainly brings honor to the product. The selections of Reznor Heaters were based upon the same three vital requirements which also interest war production industries: long and dependable OPERATION, broad HEAT DISTRIBUTION, and quick INSTALLATION with savings in cost, labor, and vital materials. Write today.

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"GAS HEATERS EXCLUSIVELY SINCE 1888"

Explosion-Proof
CONDENSATION
PUMP UNITS
Delivered from Stock

EXPLOSION-PROOF condensation pump units (either single or duplex) with capacities from 3,000 sq. ft. of radiation at 50 lbs. discharge pressure to 40,000 sq. ft. at 40 lbs. pressure. These explosion-proof units are all equipped with explosion-proof motors, starters, alternators, and conduit fittings. Sterling Explosion-proof Condensation Pump Units require 6 months to produce. We have a limited number in stock for immediate delivery. Write or wire for full specifications. Remember! Delivery from stock.

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Fundamentals are fully and clearly covered in this volume, as are the newest air conditioning methods and equipment. Correct procedure in designing complete systems for both residences and large buildings is explained step by step from the standpoint of newest practice. In addition, considerable original data on such comparatively new subjects as standards, noise control, measurements, and fire protection codes has been included.

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KEENEY PUBLISHING COMPANY
6 No. Michigan Avenue Chicago, Illinois

Gages

No. 4253—12 p. catalog of pressure, vacuum and compound gages, describing the features and construction of various types and with notes on specifications.—Certified Gauge & Instrument Corp., 34-18 Northern Blvd., Long Island City, N. Y.

Grilles, Registers, and Diffusers

No. 4254—28 p. catalog of "Uni-Flo" grilles and registers, "Venturi-Flo" overhead type air diffusers, and air distribution accessories, describing and illustrating in detail the functions of each but without showing engineering data. Numerous illustrations of features and applications are included and there are diagrams of basic fin arrangements, various combinations available, dimensions, etc.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Heat Conservation

No. 4255—24 p. manual entitled Civilian Conservation of the Btu, aimed to serve as a handy reference for care of air conditioning, refrigeration, or heating equipment. Among the subjects covered are air infiltration, bearings, belts, coils, compressors, condensers, controls, couplings, dampers, ducts, expansion valves, fans, filters, and flywheels. Also gages, humidifiers, leaks, metals, motors, refrigerant, refrigerated boxes and cold storage rooms, screens for air intakes, and spray nozzles.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Heat Transfer Through Metallic Walls

No. 4256—16 p. booklet of information and formulas for determining overall heat transfer rates through metallic walls, discussing the various factors influencing heat transfer, and the thermal conductivies of metals and alloys commonly used in construction of process equipment. A number of illustrations showing types of equipment which are characteristic of process units that depend on transfer of heat through metallic walls are included.—International Nickel Co., 67 Wall St., New York, N. Y.

Odor Adsorbers

No. 4257—4 p. folder giving a graphic example illustrating the extra service and savings which can be secured in an existing air conditioning plant through the use of odor adsorbers. According to the booklet, an average system of 30 tons capacity serving 100,000 cu ft of space, with 300 people, can serve 20 per cent more space, 20 per cent more people, and increase refrigeration and heating capacity by 20 per cent through the use of odor adsorbers—W. B. Connor Engineering Corp., Dorex Div., 114 E. 32nd St., New York, N. Y.

Plastics

No. 4258—12 p. booklet on the use of plastics in war and peace, describing the shapes in which they are available and including a table of the general properties of plastics.—R. D. Werner Co., Inc., 380 Second Ave., New York, N. Y.

Pumps

No. 4259—4 p. bulletin (W-111-B31) on horizontal, single piston pumps of the valve plate type for pressures to 250 psi, used for general services.—Worthington Pump & Machinery Corp., Harrison, N. J.

Silver Situation

No. 4260—4 p. bulletin discussing the silver situation as of July 31 and giving comments on silver conservation order M-199.—Handy & Harman, 82 Fulton St., New York, N. Y.

Steam Jet Ejectors

No. 4261—4 p. bulletin (W-205-B5A) on double element, two stage, steam jet ejectors with combined surface intercondenser and aftercondenser. — Worthington Pump & Machinery Corp., Harrison, N. J.

Strainers

No. 4262—4 p. bulletin (100) on "Ezy-Kleen" strainers, stressing the importance of protecting pumps by using strainers in intake lines and giving cross sectional views and descriptions of four types of strainers. —Blackmer Pump Co., 1809A Century Ave., S.W., Grand Rapids, Mich.

Welding Electrodes

No. 4263—14 p. bulletin consisting of a series of shop posters designed to help arc welding operators do more useful work with every electrode. Each of the six posters illustrates a common wasteful practice and shows the corresponding good practice, pointing out the ease and simplicity of doing the job the right way.—Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y.

Useful Information

Heat Transmission

The second edition of Heat Transmission, by W. H. McAdams, professor of mechanical engineering at Massachusetts Institute of Technology, continues to maintain the high standards and leadership established by the first edition some 10 years ago. Sponsored by the committee on heat transmission of the National Research Council, the second edition incorporates the new material developed in the decade since the first edition was published. The organization of the second edition is essentially the same as that of the first; however, so much new material has been added in all the chapters that no one who deals with heat transfer can afford to be without the new one.

Especially outstanding is the addition of a new chapter 11 on Applications to Design. This chapter is of value in showing the reader how to apply the formulas and methods of the first 10 chapters. In addition, chapter 3 on radiant heat has been entirely rewritten by H. C. Hottel, an outstanding authority in this field.

The past decade has seen such a large amount of research work published on heat transfer that it would be impossible for most of us to keep abreast of it. In this book, Professor McAdams has done a splendid job of organizing and synthesizing all of the published literature. His comparisons and interpretations of the results of various research workers are especially valuable. In all cases, Professor McAdams makes definite recommendations as to formulas to be used for various types of heat transfer. Also of value is the very large bibliography of research in all fields of heat transfer.

All in all, this book contains a great wealth of mate-

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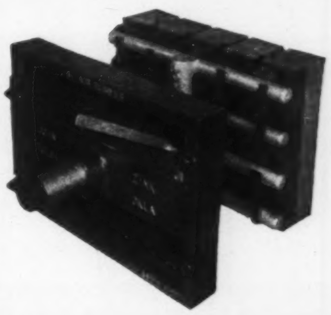

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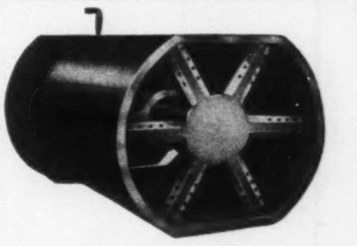

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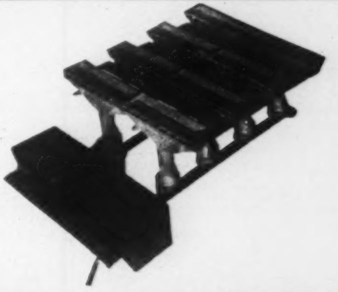

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rial. However, it is this very wealth of material which mitigates against the usefulness of the book as a text. Although homework problems are given at the end of every chapter, the book is primarily not a text book. It does provide a very fine synthesis of the research material available to date on heat transfer, and in this field it is still unsurpassed.

Chapter 1 covers the elementary theory of conduction. Chapter 2 covers the heating and cooling of solids. A large number of graphs is given to aid in the solution of conduction problems of solids of various shapes. The versatile graphical method of Schmidt is also described. Chapter 3 covers radiant heat transmission and is written by H. C. Hottel, as previously mentioned. Chapter 4 covers the elements of dimensional analysis by means of which practically all empirical heat transfer equations used today are derived. Chapter 5 covers the flow of fluids under various conditions. It is to be regretted that in this chapter the use of modified Reynolds numbers was omitted, as these modified Reynolds numbers are of value in practical work for computing either the mass velocity or the required diameter for a given pressure drop.

Chapter 6 covers the subject of heat transfer between fluids and solids, introducing the use of film coefficients. Of special use in this chapter is the description of the Colburn method for use when the value of the overall coefficient varies widely, and the diagrams given for computing mean temperature difference for various types of cross flow. In chapter 7 the heating and cooling of fluids inside of tubes is described in detail and various equations are recommended for different cases. Chapter 8 is similar in its organization to chapter 7 except that it describes the heating and cooling of fluids outside of tubes.

In chapter 9 the heat transfer from condensing vapors is described. This chapter covers not only the ordinary case of condensation of single vapors such as steam and ammonia, but also the case in which the vapor is mixed with noncondensable gases. This latter case is of special value to air conditioning engineers because it forms the basis for the theory of cooling coils and cooling towers. Considering the widespread use of such equipment, it is to be regretted that the condensation of vapors from mixtures of noncondensable gases was not treated more fully.

Chapter 10 covers heat transfer to boiling liquids. In chapter 11, as previously mentioned, the application of the data in the first 10 chapters to the design of actual heat transfer equipment is described. This chapter should be of value to the practicing engineer.

This book still remains unique in its field. There is no other which covers the field of heat transfer in such great detail and which gives such a thorough comparison between the various formulas and methods available today. It is published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Comprising 458 + xvi pp., 6x9 in., its price is $4.50.

Control Engineering

An Introduction to Control Engineering, by Ed S. Smith, patent agent, has been issued in a "very limited edition" by the C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y.

Photograph in this advertisement released by Material Div., U. S. Army Procurement Div.

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To those who have not followed automatic control theory closely, the development that has taken place in the past decade will come as something of a revelation. The entire theory of control in all its phases has been developed mathematically with fruitful results. Practice usually advances much more rapidly when an adequate mathematical theory is available as a guide.

This 135 p. book is the first, insofar as the reviewer is aware, to organize the essence of a large number of technical papers that have been published in various places. For the first time, the various elements of control engineering have been organized in a logical manner suitable for the use of students. However, it is well to warn the reader that a good grasp of mathematics is required in order to get the most out of this book, which is based on lectures by the author in a course on engineering instruments at Pratt Institute. Anyone who wishes a good general survey of modern control theory will find this book useful.

An extensive bibliography of a large number of papers is included. This bibliography should be of particular interest to research workers in the field.

Unfortunately, this book has been published in mimeographed form. It is hoped that its use will be sufficiently widespread to warrant its being set in type and published in a more readable and durable form.

Welding Handbook

The 1942 edition of the American Welding Society's Welding Handbook is a volume of over 1600 pp. which has been gotten out in response to a demand for general, up-to-date information, in concise form. It covers physics and metallurgy of welding and weldability of steels; welding and allied processes; materials used; training, inspection and safety; design considerations and testing of welding; and finally, the applications of welding. The volume is arranged generally in handbook style but the material is such that the book may be used as a text or reference.

Pipe welding—both industrial piping and pipe lines—is covered in a chapter of 42 pp.

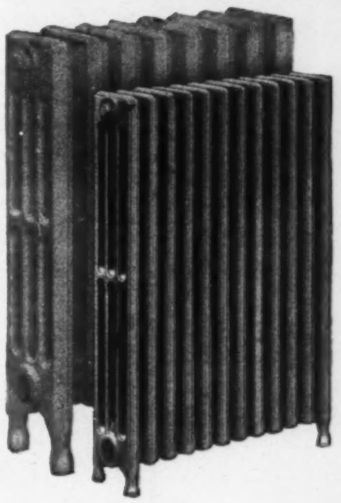
The price of this book, which may be ordered from the American Welding Society, 33 W. 39th St., New York, N. Y., is $5.00 to AWS members, $6.00 to nonmembers in the U. S., and $6.50 elsewhere.

Air Conditioning in California

Air Conditioning for Houses in California, circular No. 351 of the Agricultural Experiment Station, University of California, Berkeley, Calif., supersedes the bulletin published in 1935 on the same subject. Like its predecessor, it gives a broad picture of home air conditioning—the factors involved and the various types of equipment available. The authors are Hayden S. Gordon and R. L. Perry.

Engineers can benefit from a reading of this booklet because the requirements and conditions to be met are given in brief and well organized forms. Laymen—in the days when it will again be possible to install air conditioning in their homes—will derive considerable benefit from a reading of this booklet and avoid later disappointment with their systems.

Despite the fact that this 48 p. bulletin is intended



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specifically for California, and that Californians devoutly believe in the uniqueness of their climate, there is little in this readable bulletin that does not apply with equal truth to the rest of the United States.

Arc Welding Design and Practice

The seventh edition of the Procedure Handbook of Arc Welding Design and Practice was recently published. It includes considerable new material, with particular emphasis given to arc welding in war production work. Among the subjects covered are welding methods and equipment; technique of welding; procedures, speeds and costs; fleet fillet technique; weld metal and methods of testing; weldability of metals; welded steel construction—machine design; designing of arc welded structures; and typical applications of arc welding in manufacturing, construction, and maintenance. There is also a special section of reference data.

The publisher of this 1278 p. book is the Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio. The price is $1.50 in the U. S., and $2.00 elsewhere.

Flow of Fluids

A revised edition of a booklet, Flow of Fluids Through Valves, Fittings and Pipe, (first published in 1935) was issued recently by the Crane Co. It is identified as technical paper No. 409 and consists of 92 pp., 7¾x10⅝ in. in size.

The chief aim in its preparation was to present the newest available information on the flow of fluids, in summarized form, and to include the auxiliary data necessary to the solution of any but the most unusual

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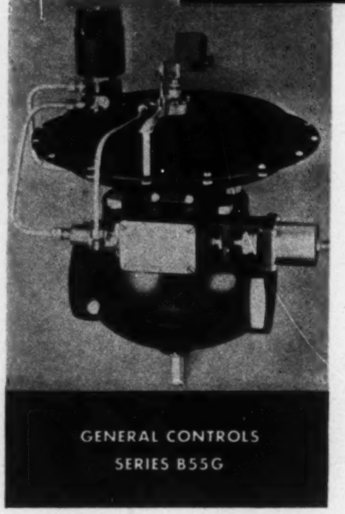

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fluid flow problems. Numerous charts are included, each of which has been made an independent unit insofar as possible in order that a minimum of reading will be required for the solution of any given problem. The working equations, tables, and charts are separated from the reading matter.

Distribution of this booklet has been limited and it is priced at $3.00.

Definitions of Electrical Terms

A new 311 p., 7¾x10½ in. book, published by the American Institute of Electrical Engineers, is devoted to the new American Standard Definitions of Electrical Terms, approved by the American Standards Association in August, 1941, and by the Canadian Engineering Standards Association in March of this year. It represents a tremendous job undertaken by a committee of 46 members who drew upon some 300 other experts for assistance.

Primary aim in the formulation of the definitions has been to express for each term the meaning which is generally associated with it in electrical engineering in America. There are many amplifying notes, extensive cross indexing, and definitions and terms in existing standards have been correlated. The definitions are carefully arranged by groups and sections according to the fields to which they apply.

To assure wide distribution of this book, it has been priced at $1.00 in the U. S., and $1.25 outside the U. S. ($1.00 in Canada if ordered from CESA). The publisher is the American Institute of Electrical Engineers, 33 W. 39th St., New York, N. Y.

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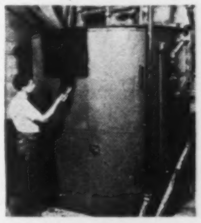

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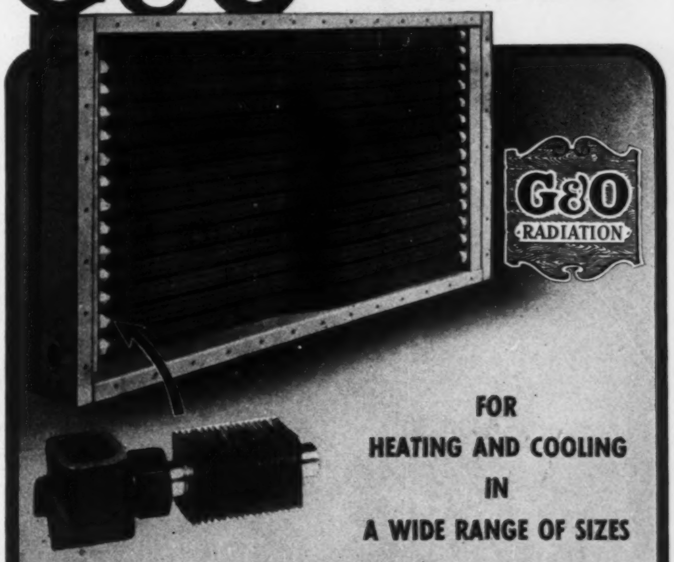

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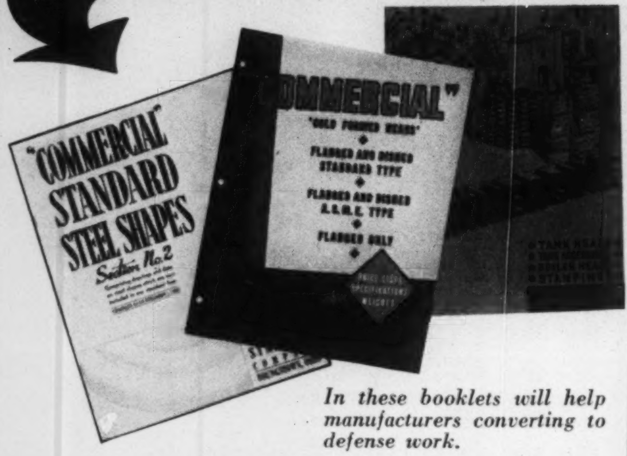
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Smoke Prevention

The Smoke Prevention Association of America, Inc., 139 N. Clark St., Chicago, Ill., has published in mimeograph form a 136 p. booklet containing the proceedings of its 36th annual convention which was held in Cleveland last June. The price is $1.00 and it includes the various papers presented and the minutes of the meeting.

Among the subjects discussed are coal and its relation to the war, by Thomas J. Thomas; a dust fall survey in Cleveland over a four year period, by Arthur E. Hutchinson; a study of atmospheric pollution, by W. F. Davidson; chimney performance and its relation to the smoke problem, by J. G. Mingle; smoke abatement in wartime, by Sumner B. Ely; and how smoke regulation departments can assist in the control, allotment, and conservation of the nation's coal, by J. F. Barkley.

Emergency Economies in Tin

The British publication Tin and Its Uses for July, 1942, is devoted to emergency economies in tin consumption. One of the articles describes a saving of the order of 99 per cent by using a cup and cone type of joint on lead pipes instead of the usual wiped joint. The ends of the pipe are shaped to male and female cones which are then sweated together. A standard lead pipe joined in this way with but 0.05 oz of solder withstood a pressure of 1130 psi, it is reported.

This publication is obtainable from the Battelle Memorial Institute, 505 King Ave., Columbus, Ohio.

Decontamination and Dehumidification of Air

In a paper on Decontamination and Dehumidification of Air by Countercurrent Washing in a Centrifugal Contactor, by Walter J. Podbielniak, Podbielniak Centrifugal Super-Contactor Co., presented before the petroleum division of the American Chemical Society at its recent meeting in Memphis, a brief report is given of typical centrifugal fractionator and solvent extractor apparatus constructions and their performance as a basis for a discussion of the centrifugal countercurrent contacting principle to air scrubbing processes. A preliminary design is submitted of an apparatus for decontaminating air from chemical smokes and contaminants used in warfare by combined centrifuging and countercurrent chemical solution scrubbing action.

The general design factors and performance characteristics of the centrifugal contactor are analyzed in application to large capacity, low pressure drop contacting of air with chemical drying solutions. The special advantages of the centrifugal contactor are pointed out in effective handling of finely divided solids and in applications requiring compactness and use of corrosion resistant metals, saving of material, etc.

The centrifugal contactor consists essentially of a wetted surface coiled into a spiral with laterally closed edges, and rotated to create a tangential component of the resulting centrifugal force to impel the liquid film with a force of up to 10 times or more gravity countercurrent to the gaseous phase passing inwardly due to pressure difference. The wetted area and vapor cross sectional area are fixed by apparatus dimensions according to desired capacity, etc. The designer also has extremely wide latitude in selecting any desired clearance between adjacent spiral walls, in selecting pitch, rpm, and passageway length; thus being able to modify performance characteristics over ranges impossible with corresponding gravitational equipment, extending up to 120 fps and higher vapor velocity, pressure drops as low as in open pipe flow, and huge capacities for low plate requirements, in compact apparatus. This flexibility of design is of especial importance in considering use of the centrifugal contactor to processing of air to decontaminate, sterilize or dehumidify it.

A preliminary design of a compact, simplified, low first cost, centrifugal contactor type of apparatus is submitted for decontamination of air from chemical war contaminants by combined centrifuging and countercurrent washing with chemical solutions. Apparatus of this general design would be intended for individual use in shelters, trucks, tanks and dugouts, as well as in larger capacities for public enclosures. Since there is considerable similarity between apparatus of this type designed for decontamination and those designed for air conditioning through chemical dehumidification, the latter can readily be adapted to serve both purposes.

A discussion is also submitted on the application of the centrifugal countercurrent contactor principle to chemical dehumidification of air, either for industrial or for comfort air conditioning purposes. The horsepower savings of using chemical dehumidification of air to reduce its relative humidity, as compared with the more usual vapor compression refrigeration methods, have been large. However, horsepower savings actually accomplished are only a small fraction of those possible by the use of efficient countercurrent contactors for the step of drying the air to lowest practical humidity through contact with drying solution, with close approach to equilibrium between air and solution at both ends of the contactor, according to Mr. Podbielniak.

Science and Practice of Welding

The Science and Practice of Welding, by A. C. Davies—a member of the (British) Institute of Welding—is a comprehensive and practical treatment of the subject. It presents the basic theoretical principles and the methods of applying them. There are chapters on welding science, metallurgy, oxyacetylene welding, arc welding, gas cutting of iron and steel, inspection and testing of welds, additional welding processes, and engineering drawing. Although written in England on practice there, it should be no less useful to American readers.

The book has been published by the University Press at Cambridge, and in this country by the Macmillan Co., 60 Fifth Ave., New York, N. Y. Its price is $2.25, and there are 436 + viii pp., 5 in. by 7½ in. size.

Erecting and Installation Work

Erecting and Installation Work, a new book prepared under the direction of E. Molloy, is intended as a "practical guide in the erection and installation of machines and structures on site". It is pointed out that the benefit of the high precision work which goes into the manufacture of engines, pumps, and other mechanical equipment can only be derived by the user by the utmost care in erection and installation.

Using British phraseology and examples, there are chapters on erecting practice, internal combustion en-

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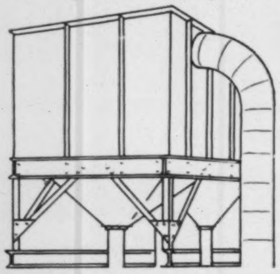

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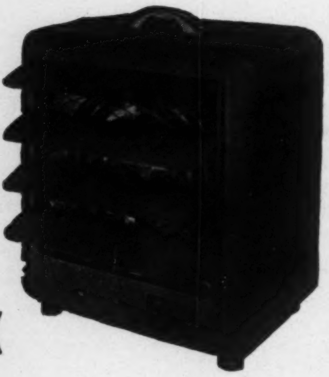

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7610 Thomas Blvd. Pittsburgh, Pa.

gines, boilers, steam engine alignment, electric motors, line shafting, and machine tools.

This book is published by the Chemical Publishing Co., Inc., 234 King St., Brooklyn, N. Y., and comprises 128 pp. of 5½ by 8½ in. size. Its price is $2.50.

Welding and Metal Cutting

A new book, Welding and Metal Cutting, prepared under the editorship of E. Molloy, covers oxyacetylene welding, electric arc and resistance welding, thermit welding, and oxygen cutting. Its purpose is to be a practical survey for engineers interested in production work, general engineering, repair work, or engineering construction.

There are 112 pp., 5½x8½ in. in size. The publisher is the Chemical Publishing Co., 234 King St., Brooklyn, N. Y., and the price, $2.50.

Mercury Poisoning in Mining

An information circular of the Bureau of Mines, identified as I.C. 7180 and dated November, 1941, is devoted to mercury poisoning as a mining hazard. It was prepared by Sara J. Davenport and D. Harrington. The contents include data on poisoning in the mining and allied industries, mode of entrance to the body, symptoms, pathological effects, toxicity of mercury, detection of mercury in air, treatment of poisoning, prevention, a glossary of medical and technical terms, and a bibliography.

It is pointed out that "good ventilation (preferably mechanical) is necessary to remove the dust and vapor

DOES NOT STAIN HANDS or FIXTURES

Take a tip from other master piping contractors and plant engineers and use Rutland Pipe Joint Cement on every job. It seals joints tightly—lasts indefinitely—yet always leaves pipes easy to disjoin. Legal for use in all cities because no toxic ingredients. Remains soft in can.
Mail post card for free sample. Rutland Fire Clay Company, Department H-9, Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patcher.

RUTLAND
PASTE PIPE JOINT CEMENT
RUTLAND FIRE CLAY CO.
RUTLAND, VT.

that inevitably contain some mercury wherever the metal or its compounds or ore is used or handled." In mining "the most important measure is thorough ventilation to remove the dust and fumes and cool the air."

Combustibles in Manholes

Bureau of Mines Report R.I. 3604, dated January, 1942, covers investigations during 1938, 1939, and 1940 of combustibles in manholes in Boston. It was prepared by G. W. Jones, T. H. Haines, T. F. Smith, and W. J. Huff.

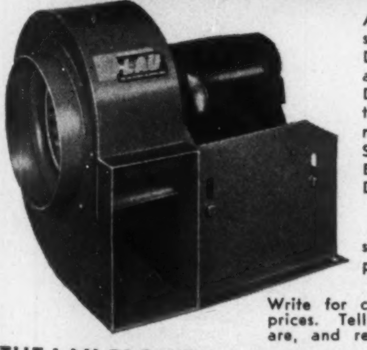
Purpose of this investigation, which has been conducted since 1929, is to obtain information as to the actual explosion hazards in a large city and to determine the value of systematic manhole surveys for the purpose of eliminating explosion hazards in underground openings.

Coming Events

Air Conditioning and Refrigeration Victory Program

Victory Program of the Refrigeration and Air Conditioning Industry: Series of meetings—to be held in New York, September 14; Dayton, September 16; Chicago, September 18; St. Louis, September 21; and Los Angeles, September 25—at which a detailed plan of conservation will be presented. Director of the Victory Program is John K. Knighton, 119 Morton Ave., Evansville, Ind.

LAU
SINGLE INLET
BLOWERS
for the war effort



Available in three different series — Direct Drive, Direct Drive with Gearhead Motor, and Belt Drive (Single or Double Inlet). Wheel diameters—5" up to 30". Various motor characteristics. Besides Single Inlet Forward Curve Blowers, we also manufacture Double Inlet Blowers.

Orders can be filled in reasonable time providing proper priority can be furnished.

Write for catalogs, capacity chart, and prices. Tell us what your requirements are, and representative will call.

THE LAU BLOWER CO., Dept. HP9, DAYTON, OHIO
Established Air Handling Equipment Manufacturers

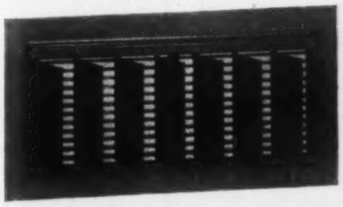
BLOWERS • FANS • WHEELS • PILLOW BLOCKS
LAU
THERE'S A SALES ENGINEER NEAR YOU

Specify
STANDFORATED
PERFORATION OF ALL METALS
ADJUSTABLE
AIR CONTROL GRILLES
Perfect for Defense Projects!

STANDFORATED Precision Processing provides top quality and super-efficiency at moderate cost. Scientific design, strength and durability meet rigid specifications for all types of Defense Building!

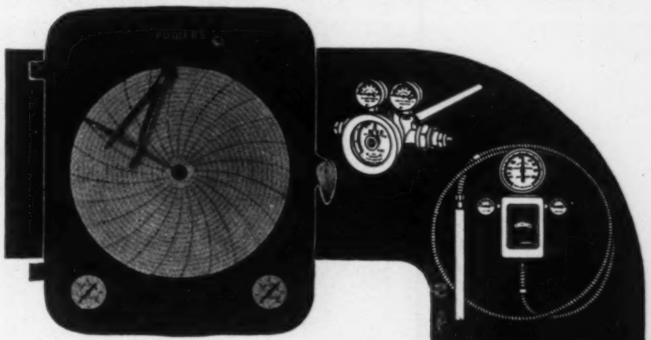
QUALITY
EFFICIENT
VOLUME
CONTROL
REGISTERS

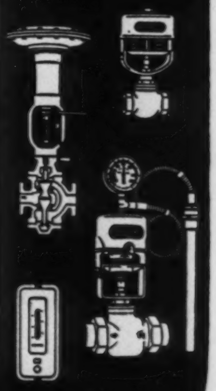
No. 500HA — 4-Way Deflection. Vertical deflecting louvres on back individually operated left or right. Horizontal grille bars on face adjustable in groups for up or down deflection.



STANDARD
STAMPING & PERFORATING COMPANY
3151 W. 49th PLACE • CHICAGO, ILLINOIS

WRITE FOR CATALOG
STANDFORATED GRILLES
BEND-EZY REGISTERS
INDUSTRIAL & ORNAMENTAL
PERFORATIONS & STAMPINGS





When you want accurate and dependable automatic temperature and humidity control for Air Conditioning Systems or Industrial Processes call in a Powers engineer. With a very complete line of self-operating and compressed air operated controls we are well equipped to fill your requirements.

Write for Circular 2520

THE POWERS REGULATOR CO.
2759 Greenview Avenue, CHICAGO
Offices in 47 Cities—See your phone directory
50 Years of Temperature and ★ Humidity Control ★

POWERS
★ TEMPERATURE AND ★
HUMIDITY CONTROL

AIR CONDITIONING
NOZZLES

YARWAY
INVOLUTE

Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-616.

YARNALL-WARING COMPANY
107 MERMAID AVENUE
PHILADELPHIA

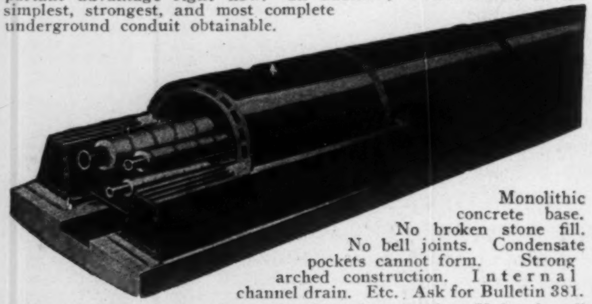
YARWAY

THERM-O-TILE
Reg. U. S. Pat. Off.

SAVES METAL

Help win the war by enclosing your underground pipe lines in efficient non-metallic Therm-O-Tile.

The amount of metal in Therm-O-Tile is practically nil. Pipe supports and saddles require the only metal—an exceedingly important advantage right now. In addition, Therm-O-Tile is the simplest, strongest, and most complete underground conduit obtainable.



Monolithic concrete base. No broken stone fill. No bell joints. Condensate pockets cannot form. Strong arched construction. Internal channel drain. Etc. Ask for Bulletin 381.

Sold and installed by Johns-Manville Construction Units in all Principal Cities. See our page in Sweet's or The Heating Guide.

H. W. PORTER & CO., Inc.
822-H Frelinghuysen Ave., Newark, New Jersey

Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective job, on which we shall be glad to have your ☐ comments, ☐ quotations.

Write your name, firm, and address on the margin of this page, tear out with the checked squares above, mail, and you will hear from us promptly.

Welding in War Production

American Welding Society: Annual meeting, October 12-16, Hotel Cleveland, Cleveland, Ohio, in conjunction with National Metal Exposition to be held in Cleveland Public Auditorium the same week. Theme of the meeting will be welding in war production, and technical sessions will include welding of aircraft, ships, tanks, and ordnance materiel; training welding operators and qualification; localized heat treatment; residual stresses and their relief; weldability of steel; gas cutting; resistance welding fundamentals; brazing and soldering; structural design; and non-destructive tests and inspection. Headquarters office of the AWS is at 33 W. 39th St., New York, N. Y.

Chemical Exposition

National Chemical Exposition: November 24-29, Hotel Sherman, Chicago, Ill. Sponsored by Chicago section of American Chemical Society. Manager of the exposition is Marcus W. Hinson, 110 N. Franklin St., Chicago.

Power Show

15th National Exposition of Power & Mechanical Engineering: November 30-December 5, Grand Central Palace, New York, N. Y. According to the management, exhibitors are planning displays that will help the war production program by showing how to get more out of existing equipment, and ways and means of preventing shutdowns and insuring continuous operation. Under management of International Exposition Co., Grand Central Palace, New York, N. Y.

You're Sittin' Pretty if you have any OLD DART UNIONS You Can Put 'em Back to Work

Lucky is the man who has some old Dart Unions kicking around his plant. For you'll find that those old discards can be put back on the job with excellent results. And this is right in line with Uncle Sam's program. The more metal you save, the more he can use for his guns, tanks, ships, and planes.

The reason you can re-use Dart Unions again and again and still get a stay-tight fit is an old story. Dart Unions are long-service Unions. Their bronze, matched seats are ground to "true-ball" surfaces—and their air-refined, malleable iron nuts and bodies stand up under rough handling.

So get out your old Dart Unions and let them work side by side with the new ones you buy from your supplier.

DART
UNIONS
E. M. DART MFG. CO., PROVIDENCE, R. I.

THE EDITOR'S PAGES

CONSERVATION MEETING TO BE HELD IN CLEVELAND

The "all industry" meetings sponsored by the Victory Program of the Refrigeration and Air Conditioning Industry, which were announced as to be held in five cities during September, were postponed (except for the Los Angeles affair) because of insufficient time for proper preparation of the required material. As we go to press, we are informed by John K. Knighton, director of the program, 119 Morton Ave., Evansville, Ind., that the second and largest of the meetings will be held in Cleveland at the Carter hotel on Wednesday, October 21, starting at 1:30 p. m.

SAVE
SIMPLIFY
SUBSTITUTE
REFRIGERATION AND AIR CONDITIONING PROGRAM FOR VICTORY

Purpose of the meeting is to explain a detailed plan of conservation involving product design, production, application, installation, service and maintenance. George Taubeneck is general chairman, and co-chairmen include John Wyllie, Jr., Paul Zimmerman, Frank Smith, C. V. Hill, Jr., Alex Holcombe, Jr., and E. A. Plesskott. Speakers are A. B. Schellenberg, Henry Dinegar, and Messrs. Knighton, Taubeneck, and Zimmerman.

Those who plan to attend are asked to notify one of the co-chairmen, or Mr. Knighton.

CHARLES E. WILSON TO WAR PRODUCTION BOARD

Charles E. Wilson, president of the General Electric Co., was named vice-chairman of the War Production Board, in that capacity acting as chairman of the newly organized production executive committee, it was announced September 17.

At a special meeting of G.E.'s board of directors on September 18, Mr. Wilson's resignation as president and director was regretfully accepted. Chairman Philip D. Reed is also in the service of the government. Honorary Chairman Owen D. Young and Honorary President Gerard Swope were requested to resume their original responsibilities, Mr. Young as acting chairman and Mr. Swope as president of the company.

INTERPRETATION OF PRIORITIES REGULATION 12 ISSUED

Companies operating under the production requirements plan must not use the rerating provisions of priorities regulation No. 12 to expedite delivery of materials for the improvement, expansion, or construction of their own plants, it was made clear in interpretation No. 1 to the regulation, announced last month by the WPB director general for operations.

Issuance of the interpretation was accompanied by a statement by the War Production Board's compliance branch that it was inaugurating an investigation of the uses which have been made of AA series reratings in connection with purchases of capital equipment. Branch officials said that in many instances deliveries of capital equipment have been rerated AA-1 or AA-2, and stated that in most cases these ratings probably were contrary to correct priorities procedures.

VICTORY STORE WINDOW FEATURES AIR CONDITIONING

A unique window display idea, adaptable for use by air conditioned department stores, specialty shops, and restaurants, has been developed by the Addis Co., Syracuse, N. Y., in cooperation with Carrier Corp. Addis installed a window display featuring a prominent placard which states: "If an air raid comes, the Addis Co. will provide comfort with air conditioning. The air in our store is cooled, dehumidified, cleaned, and circulated."

The glass in the store window was taped up in accordance with regulations of the Office of Civilian Defense which suggest "textile materials may be used in strips. The pattern should leave open rectangular spaces not greater than about 6 in. each way. Surgical adhesive tape (which need not be medicated) and insulation or tire tape are typical materials in this class."

The window features a victory V.

FUEL OIL RATIONING begins this month, and it becomes the patriotic duty of all of us to save fuel by heating efficiently. Wide discrepancies between fuel or steam consumption rates for heating buildings and plants indicate that there are numerous opportunities for conserving heat and supplying it more efficiently. Conservation is always good business—now it is a wartime "must"

Uncle Sam wants YOU to fight... WASTE!
Save Fuel — by Heating Efficiently

THE EDITOR'S PAGES

Continued

WARTIME PUBLIC RELATIONS TOPIC AT OCTOBER 22 MEETING

The fostering of peacetime markets by continued improvement in public relations during wartime will be discussed at the annual meeting of the Plumbing and Heating Industries Bureau in the Palmer House, Chicago, on Thursday evening, October 22, according to H. O. Nelson, president of the bureau. The meeting coincides with the fall convention of the Central Supply Association scheduled for October 22 and 23 at the Palmer House.

All members of the various associations of manufacturers, wholesalers, and contractors, as well as individual contributors, comprising the bureau, are invited to the dinner meeting, Mr. Nelson says. Early reservations are suggested.

PROJECT APPLICATION FORM PD-200 REVISED

A revised project application form PD-200, which is to be used for obtaining priority assistance and authority to begin construction for most construction items and equipment, is available for use, the War Production Board has announced. This form must be used as an application for authority to begin construction pursuant to the provisions of the stop-construction order L-41; priority assistance for any project involving new construction, reconstruction, remodeling, or conversion; and priority assistance for equipment when construction is involved. (PD-1A applications formerly submitted for such equipment will no longer be accepted. When no construction is involved, however, PD-1A's will continue to be accepted for equipment.)

This revised PD-200 form does not replace PD-105, used for privately financed war housing, or PD-406, used for remodeling houses in critical defense areas. Neither does it replace form PD-3A, used for projects owned by the armed services and identified as "command" construction.

PD-200 applications are available at all WPB field offices, the county war boards of the Department of Agriculture, field offices of the Federal Housing Authority, field offices of the Army, Navy, and Maritime Commission, and many financial institutions.

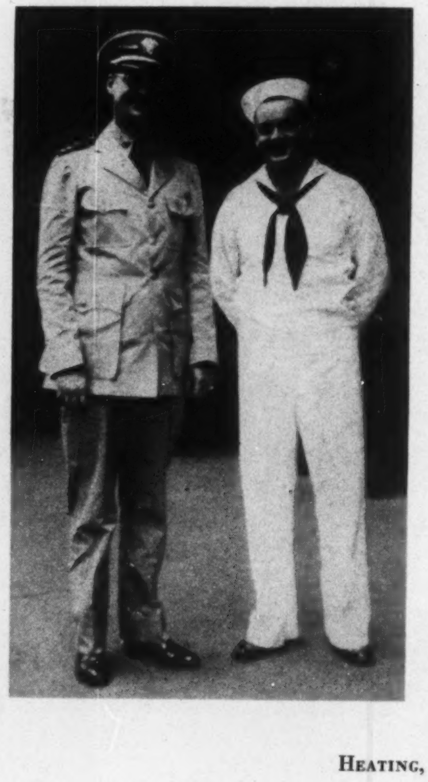
The coverage of the new PD-200 form has been increased and more detailed information is required. For simple types of construction, however, instructions have been drawn in such a manner that an applicant need fill out only the portion of the form applicable to his particular case.

The form is now used in other than "command" construction. To reduce delays in processing, the PD-200 form has been correlated with the utilities application for utilities work in connection with a construction project.

Machinery and equipment required for a project have been separated from the construction materials and are listed in new sections. The machinery section has been divided among metal working equipment, power equipment, and other machinery and equipment. The materials list has been increased.

OLD FRIENDS MEET

Lieut. R. Payne Wettstein and Lawrence A. Doyle, signalman 3/c, meet in uniform for the first time. Both were formerly on the staff of HEATING, PIPING & AIR CONDITIONING, and Lieut. Wettstein was also secretary of the Keeney Publishing Co.



APPLICATIONS FOR REPLACING DISPOSSESSED PROPERTY

A method of expediting emergency applications to rebuild or replace property dispossessed because of acquisition for use by war agencies was announced last month by the War Production Board.

Although such applications for authorization to begin construction should be filed in the usual manner, government agencies in the field now may telegraph pertinent information to the construction bureau of WPB in New York where a special staff has been organized to expedite such cases. A considerable saving in time is effected and in instances where applications are approved, telegraphic authorizations to begin construction are sent promptly to applicants.

It is necessary for the party dispossessed to receive a letter from the authorized officer representing the armed services or government agency concerned, identifying the property and establishing the fact that it has been acquired for war use.

Information applicants should give government field offices for transmission to the construction bureau includes the following: Name and present location of applicant; name of government agency submitting confirming letter and reason for emergency; location of new construction; number, type, size, and value of buildings and other appurtenant construction of the dispossessed property; number, type, size, and value of new construction; kinds and quantities of all new materials involved in the construction and costs in dollars. The latter should include, for instance, the cost of heating and plumbing equipment, the cost of pipe, the cost of electric wiring and fixtures, and similar data.

* * *

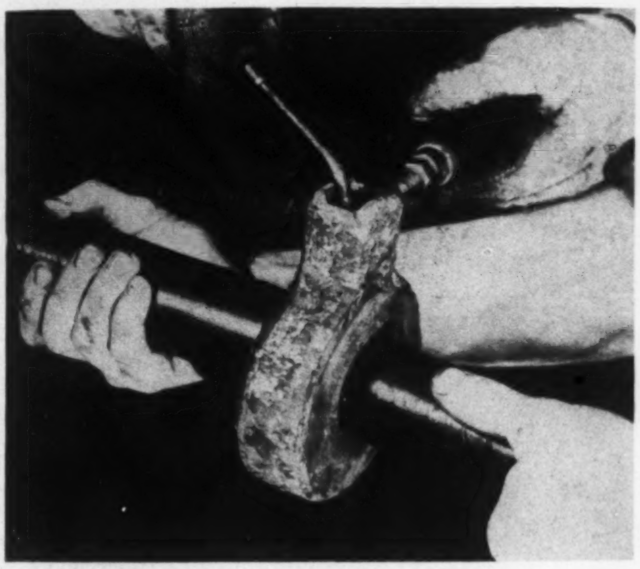
Every American should salvage every pound of metal, rubber, and other needed material and start it on the way to war production without delay. Industrial salvage is particularly important—but don't forget home, office, and farm, too.

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1942, HEATING, PIPING & AIR CONDITIONING *and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk* (*) *indicates equipment not listed in Directory Section; double asterisk* (**) *equipment and manufacturer not listed.*

Thermoplastic Pipe

No. 2351—Following the announcement of "Saran" tubing comes another plastic development—"Saran" thermoplastic pipe. According to the manufacturer, it is available for a wide variety of industrial uses and in many installations can replace strategic material such as metals and rubber. It is produced by a modified extrusion process and has dimensions identical with those of extra heavy iron pipe. At present, there are six sizes ranging from ½ through 2 in. IPS, with larger sizes to be available in the future.

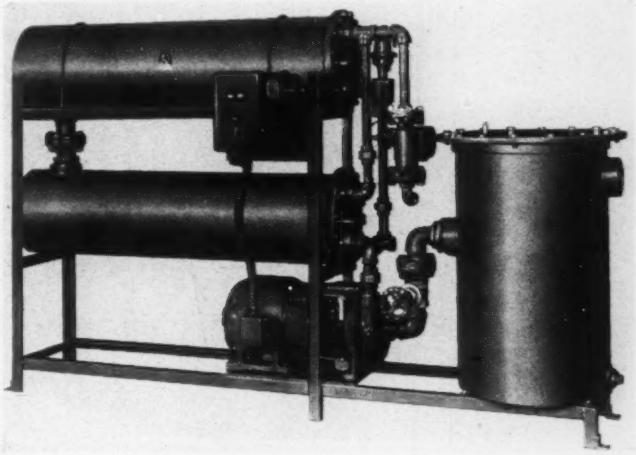


This pipe can be welded, or can be threaded with standard pipe dies. Welded fittings can be fabricated, and standard flanges and other fittings are available. The illustration shows gas flame heat being applied to a hot plate for welding two lengths of the pipe together in the field.—Dow Chemical Co., Midland, Mich.

Quench Oil Strainer

No. 2352—A new kind of oil strainer, specifically designed for quench oil cooling, is shown attached to two interconnected oil coolers. It affords relief from former penalties of excessive cleaning, power waste, or loss of pump capacity, says the manufacturer.

"B & G Full-Flo" oil strainers employ two features which permit thorough cleaning of the oil without restricting free flow. First, they are sized to accumulate large amounts of scale before cleaning becomes necessary. Second, their screens are meshed to meet various operating conditions without clogging and yet affording full protection to the pump.



These oil strainers are not rated by pipe size, but are rated to permit the maximum flow of oil which the pump can deliver if there is a minimum of resistance in the suction line. Thus, a pump protected by one of these strainers will not be "starved," but will deliver its full rated capacity at all times, it is stated.—Bell & Gossett Co., Morton Grove, Ill.

Cooling Tower Fan with Plastic Blades

No. 2353—The blade of the new "Hartzite" cooling tower fan is made of plastic and fabric combined under heat and pressure. According to the manufacturer, the plastic material makes the blade highly resistant to moisture, corrosion, and abrasion damage and the fabric gives multiple cross-graining which increases strength and wearing qualities. The blade is the result of some years

HEATING, PIPING & AIR CONDITIONING,
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Trade Literature. (*Circle each number in which you are interested*):

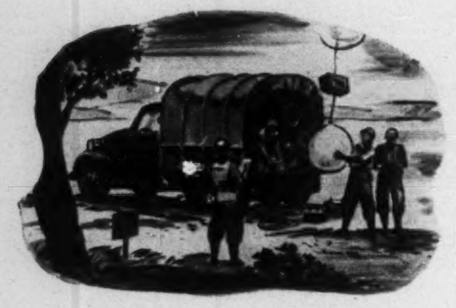
2351	2352	2353	2354	2355	2356	2357	2358	2359	2360
2361	2362	2363							
4264	4265	4266	4267	4268	4269	4270	4271	4272	4273
4274	4275	4276	4277	4278	4279	4280	4281	4282	4283
4284	4285	4286	4287	4288	4289	4290	4291	4292	4293
4294									

Name.............................. Title..................

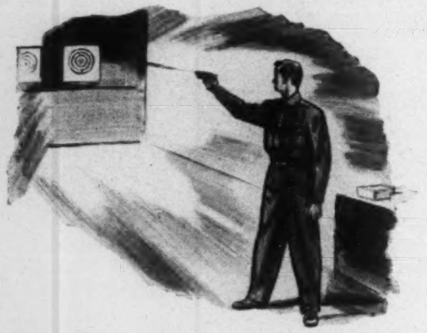
Company ....

Address ....

City ....State ....

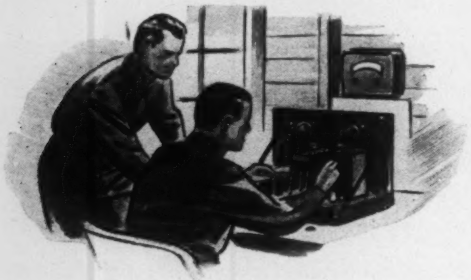


Weather forecasting is made more accurate with the aid of test cabinets. Instruments that are sent up into thin cold air are checked in low temperature cabinets both before and after they are released so that corrections can be made for mechanical inaccuracies.



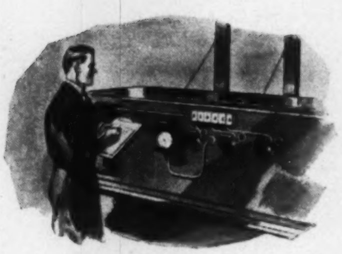
Cartridges are chilled to a temperature of 58 degrees F below zero in test cabinets . . . then fired to ascertain the effect of these conditions on muzzle velocity as compared to velocities at room temperature.

With military planes continually seeking to operate at higher altitudes, almost every piece of equipment that goes into them must be subjected to rigid low temperature tests. Magnetos, ignition systems, wiring, instruments, oil, rubber—even pilots themselves.



Radio equipment is tested by the U. S. Army in low temperature cabinets; so are electric cables. The Navy, too, uses test cabinets in checking electric cable.

Do these test cabinet applications give you ideas?



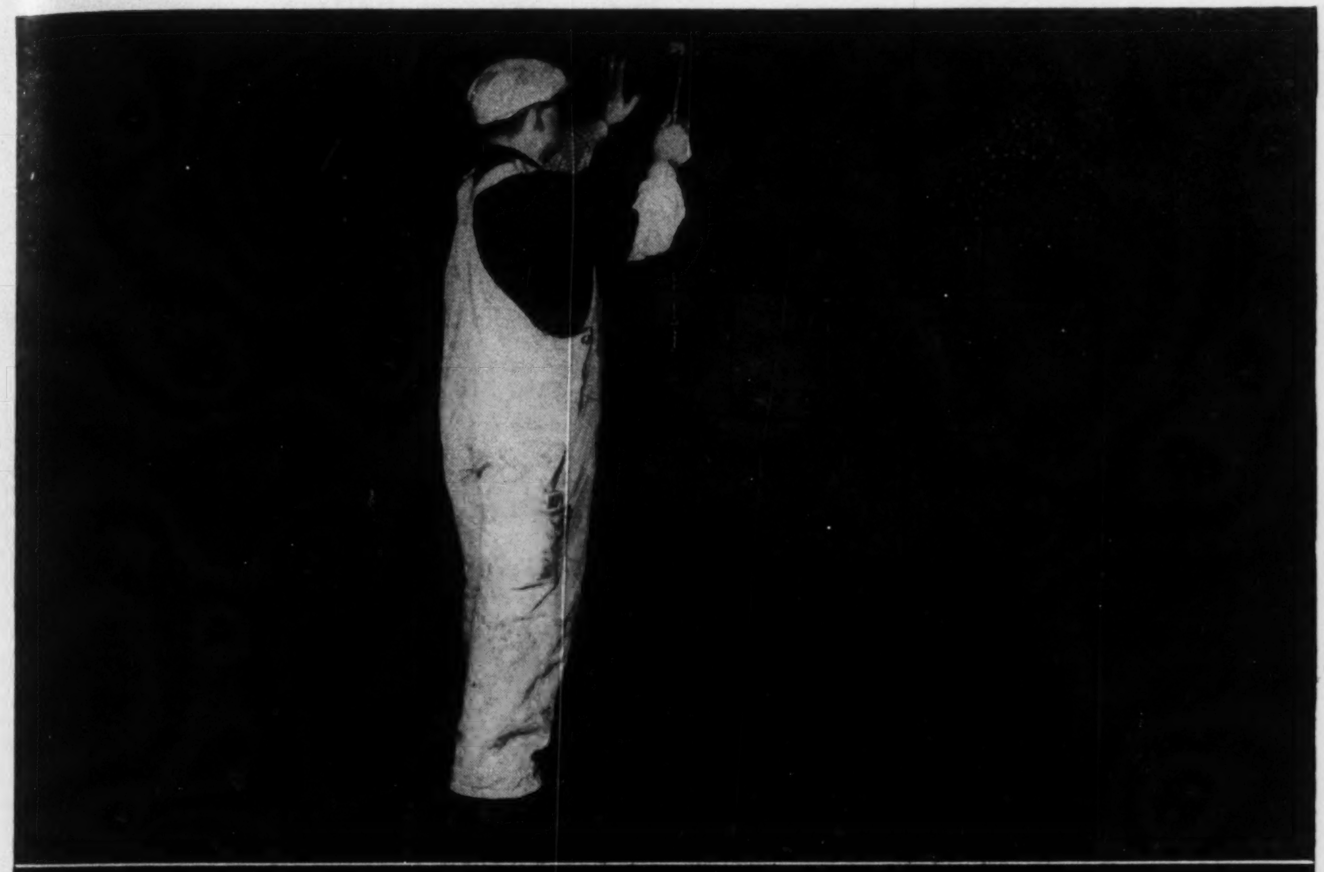
THE widely differing production and test problems shown on this page are a few of those that have been solved with low temperature test cabinets, cold rooms or stratosphere chambers. Perhaps you, like so many other engineers, will find General Electric equipment the answer to a perplexing temperature problem involving precision work, research, or Army and Navy needs.

Naturally each test cabinet application involves different requirements and must be treated on such a basis. The possibilities in this new and growing field are limitless.

Let G-E engineering ability aid you . . .

Perhaps the experience gained by G-E engineers in planning air conditioning and refrigeration applications of all kinds can be helpful to you. If so, write to General Electric, Div. 25510, Bloomfield, N.J.

GENERAL ELECTRIC



Good news!...prompt delivery on cork insulation for priority work

If you're planning construction which rates a priority of A-10 or better and requires low temperature insulation, you'll be glad to know that Armstrong's Corkboard and Cork Covering are available for prompt delivery.

Large quantities of corkboard and cork covering have been furnished within the past year for essential war work including powder plants, oil refineries, ships, synthetic rubber plants, cold storage rooms for Army camps, refrigerated cabinets and truck bodies, wind tunnels, and sub-zero test rooms. Despite ocean shipping difficulties, ample supplies of cork have arrived regularly and the stock on hand remains at a good level.

Armstrong's Corkboard and Cork Covering are ideally suited to these essential jobs because they provide lasting and dependable protection. They form an efficient barrier to the passage of heat. They hold low temperatures under accurate control and with a minimum of refrigeration. Corkboard and Cork Covering are strong and rigid, yet light in weight, and stay in place.

TWO OTHER ARMSTRONG'S MATERIALS FOR LOW TEMPERATURE INSULATION

Two additional Armstrong's Insulations, Mineral Wool Board, and Foamglas are available for ordinary installations as well as those carrying priority ratings.

Armstrong's Foamglas—a brand-new form of glass made up of thousands of tiny airtight cells which provide an efficient heat barrier. Because Foamglas is vaporproof, it keeps its original insulating efficiency permanently. It is light in weight, has unusual compressive strength, is noncombustible, verminproof, and odorless. The block size is 12" x 18" in 2", 3", 4½", and 6" thicknesses.

Armstrong's Mineral Wool Board—a new noncritical material basically mineral wool with a waterproof binder. It is made in a strong board form, has a low thermal coefficient, good moisture-resistance and is free from objectionable odor and from any liability to rot, mold, or harbor vermin. Armstrong's Mineral Wool Board is made in one standard size, 12" x 36", and in thicknesses from 1" to 4". It is quickly and easily erected and will stay in place without settling or warping.

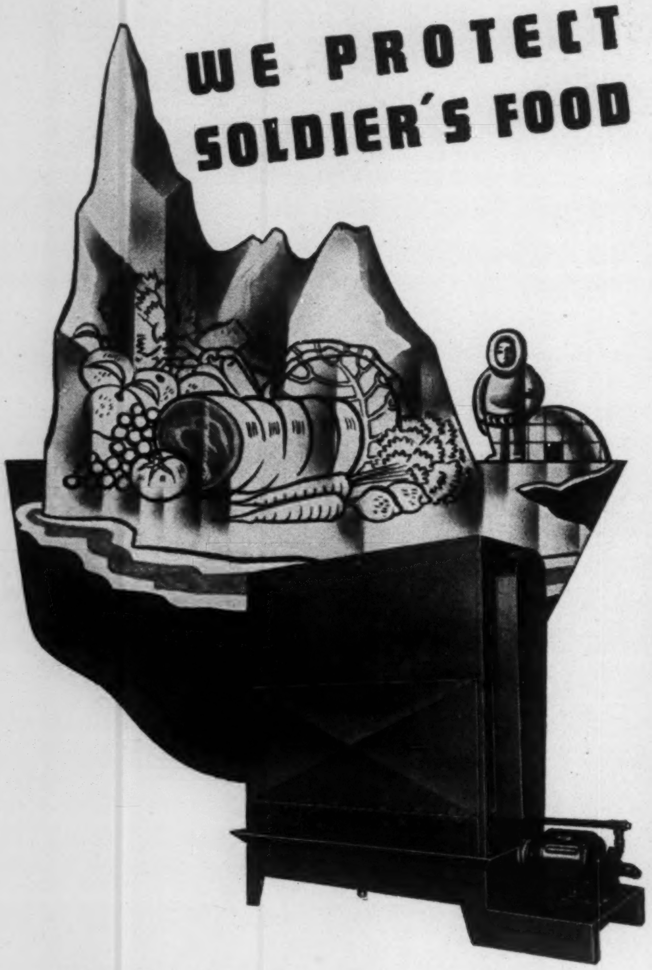
Whatever your insulation needs may be, one of these efficient materials should prove highly satisfactory. Get the facts about all three today and take advantage of the engineering help available at "Insulation Headquarters." Write now to Armstrong Cork Company, Building Materials Division, 994 Concord Street, Lancaster, Pennsylvania.

ARMSTRONG CORK COMPANY

Insulation Headquarters

Corkboard • Cork Covering • Temlok • Fiberglas* • Mineral Wool Board • Foamglas

*Reg. U. S. Pat. Off. O.-C. F. Corp.



We protect soldier's food by making refrigeration equipment for the armed forces at the home front and abroad. Most of our capacity is taken up by this essential war work.

If you will have patience with us, you will find us always willing to cooperate with you as far as these trying conditions permit.

"MARLO MEANS HEAT TRANSFER EQUIPMENT"

MARLO
COIL COMPANY
ST. LOUIS, MISSOURI

BUY WAR BONDS AND STAMPS

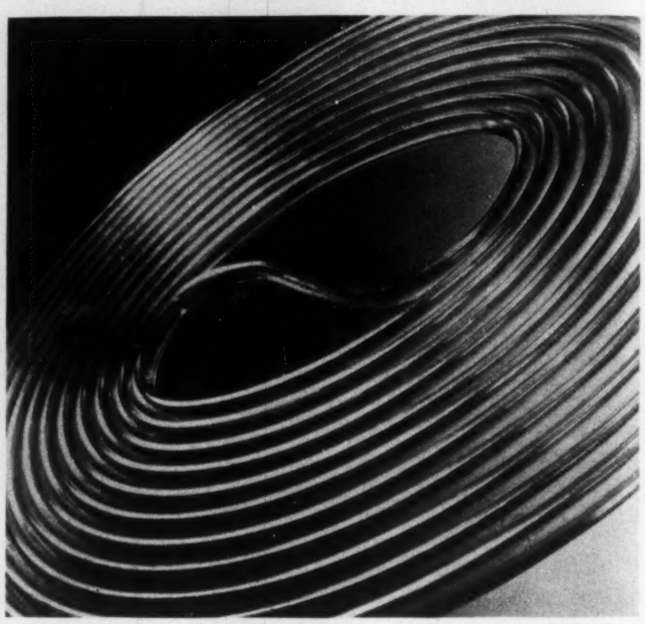
of experiments and tests involving many different materials, combinations of materials, and methods of manufacture.

The all steel welded hub retains the manufacturer' adjustable pitch feature, by which a wide range of ai deliveries can be obtained.

These fans are available in 10, 11, and 12 ft diameters and in four and six blade assemblies.—Hartzell Propelle Fan Co., P. O. Box 909, Roosevelt Ave., Piqua, Ohi

Transparent Plastic Pipe

No. 2354—Transparent "Tenite" pipe is now availabl in the standard sizes used in beverage dispensing industries. According to the distributor, it has already bee accepted by leading breweries to replace block tin pip in the brewing industry and in dispensing draft bee. It can be readily formed into spiral and flat coils.



The pipe is stocked in both long length coils and 12 ft straight lengths. The diameters range from $\frac{3}{16}$ to 1½ in. OD.

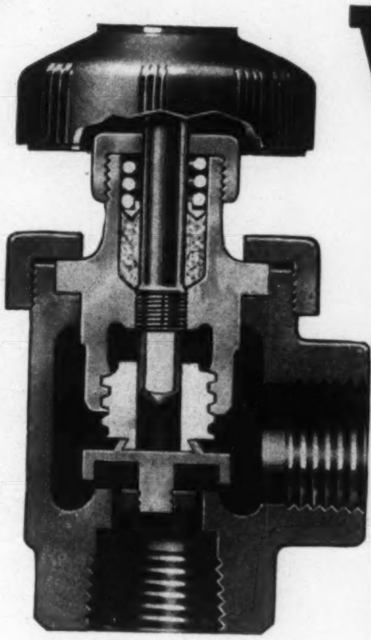
This pipe is manufactured from a cellulose acetate butyrate formula produced by Tennessee Eastman Corp., Kingsport, Tenn. It is extruded in continuous seamless lengths by Extruded Plastics, Inc., Norwalk, Conn., and distributed by North Penn Co., 72 Fifth Ave., New York, N. Y., under the name of "Pennco."

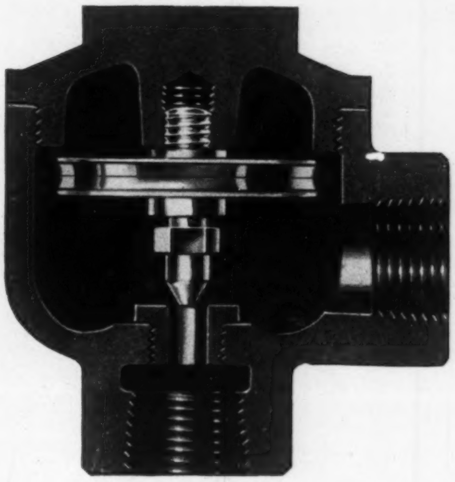
Preventing Atmospheric Moisture in Tanks

No. 2355—The "Lectrobreather" is a unit recently developed to prevent the entrance of atmospheric moisture into oil and chemical tanks. It permits only dry air to enter the tank when it is emptied or when air enters due to temperature drops. Air leaving the tank, being thoroughly dry, has a partial reactivating effect which makes possible long periods between reactivations.

These units are mounted either directly on the tank or piped to it and are equipped with a color indicator for determining when reactivation is needed or when it is complete. Where breathers are required for several tanks, the standard practice is to use one breather on

Doing their part for VICTORY





Conforming to the simplification program of the War Production Board, the new line of Illinois Traps and Valves with cast iron bodies and bonnets, uses a minimum of critical metals. The same efficient and dependable Illinois features of the internal working units are retained. Female inlet and outlet connections, with left-hand thread on inlet. Valves and traps are all furnished in angle pattern. Series GW Traps are made in three sizes: ½-inch for 200 sq. ft.; ¾-inch for 400 sq. ft.; ¾-inch for 750 sq. ft. nominal rating. Series 40W Valves are made in two sizes, ¾-inch and 1-inch.

ILLINOIS HEATING SYSTEMS AND STEAM POWER SPECIALTIES

In war production plants all over America you will find Illinois equipment controlling steam circulation, pressures and temperatures for heating or process work — among them the world's largest bomber plant. ***Consult us on your requirements or write for bulletins.***

ILLINOIS ENGINEERING COMPANY
2047 SOUTH RACINE AVENUE, CHICAGO

ARE YOU THE

Invisible Man

BEHIND THIS GUN?

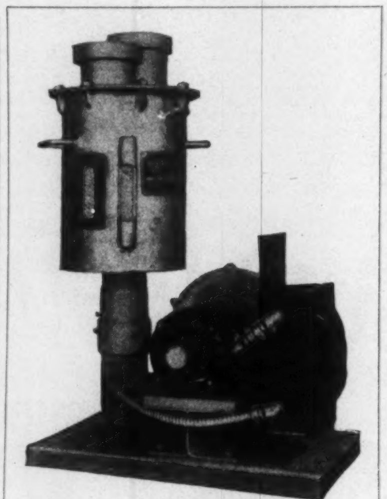
Into every Patterson Hot-Water Storage Heater goes enough steel to make a 105 mm anti-aircraft gun. Multiply that in terms of nation-wide heater requirements, and what is the result? Enough long-range A.A. guns to put up a withering curtain of fire against enemy air armadas.

Your willingness to do without a new Patterson heater . . . your cooperation in getting maximum service out of present equipment helps to put one more gun on the firing line. In a very real sense, that makes you an important member of the sweating crew behind that gun.

Of course, hot water storage heaters are pretty important items in themselves. That depends on the use or industry for which they are intended. But the necessities of war require that the materials from which they are fabricated be rationed strictly according to priorities. If your priority ratings justify the use of the steel or other strategic metals required to fill your orders, Patterson-Kelley will continue to supply you with heaters and all types of heat-transfer equipment.

PATTERSON-KELLEY FOR DEPENDABLE ECONOMICAL SERVICE

THE *Patterson-Kelley* CO., INC.
107 WARREN ST., EAST STROUDSBURG, PA.

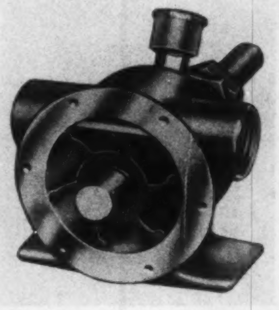


each tank and a central reactivator for all breathers. The reactivators are built for electric operation as standard for all units or for steam operation on the two larger units. Special breathers are available for use on transformers or other equipment where atmospheric moisture is harmful.

These breathers use activated alumina adsorbents. They operate on the same principle as "Lectrodryer" equipment which is used in many industries for drying compressed air, gases, and for maintaining lower than normal relative humidities in rooms.—Pittsburgh Lectrodryer Corp., P. O. Box 1766, Pittsburgh, Pa.

Pump with Synthetic Rubber Impeller

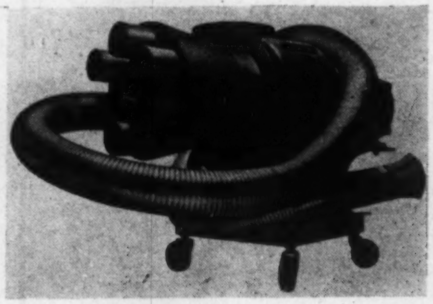
No. 2356**—A new pump, designed to handle either thick or thin liquids without requiring priming each time it is started, has a "Neoprene" rubber impeller. Simple in construction and operation, the impeller fits snugly inside the pump housing and creates near vacuum, thus eliminating any need for priming, says the maker.

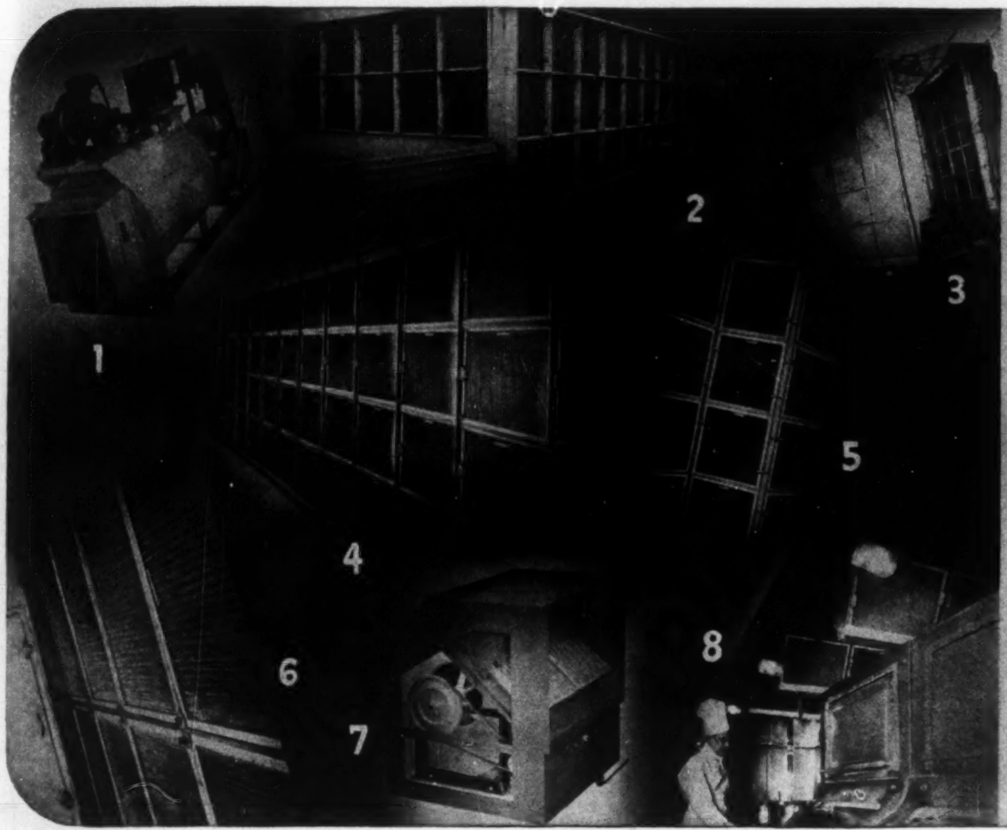


Adaptable to fields wherein pressure requirements are low, the pump may be operated in either direction and mounted at any angle. It is available in ¼ to ¾ in. sizes with capacities from 2½ to 22 gpm.—Jabsco Pump Co., 8304 Wilshire Blvd., Los Angeles, Calif.

Exhauster and Ventilator

No. 2357*—A new exhauster and ventilator, called the "Octopus," has been especially designed for use in ship holds, mines, sewers, tunnels, and welding departments, and may be placed or hung in any convenient place between the working area and the open air. It is connected by means of flexible metal hoses.





1. Well known industrial unit heater is AIR-MAZE equipped.
2. Typical AIR-MAZE installation in Detroit industrial plant.
3. AIR-MAZE installation in mid-western department store.
4. Large Cleveland bank building uses AIR-MAZE Air Filters.
5. Famous air conditioned Toledo cafeteria is AIR-MAZE equipped.
6. AIR-MAZE installation in one of New York's largest hotels.
7. Cut-away view of modern blower unit with AIR-MAZE filters.
8. AIR-MAZE Greastop filter installation in kitchen canopy of Detroit restaurant.

AIR-MAZE PERMANENT PANELS

for Every Air Filter Application

Industrial • Commercial • Institutional

TWO OF THE MANY AVAILABLE AIR-MAZE FILTER PANELS

AIR-MAZE "A" PANEL

A heavy duty type air filter of multiple graduated density for protecting Engines, Compressors, Blowers and Severe Service Air Conditioning Systems.

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Provides the economical solution for lighter service air conditioning systems, Unit Air Conditioners, Room Coolers, Furnace Blower Cabinets and Window Ventilators.

● The result of nearly twenty years of specialized engineering experience, AIR-MAZE Permanent Air Filter Panels embody every characteristic essential to the successful solution of air filtering problems in every field—industrial, commercial, institutional, and residential. Their long-range economy, high efficiency, large dust holding capacity, low pressure drop, and ease of cleaning have all been proved by scientific test as well as actual use. In the wide range of more than 3,000 types and sizes, there is an AIR-MAZE Filter Panel for every application to meet your particular requirements. Write for details.

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DEPENDABLE AIR FILTERS FOR EVERY APPLICATION

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TRADE MARKS REG. U.S. PAT. OFF.
THREDOLETS
Welded Outlets for Every Piping System

How to Make Any Right-Angle Welded Branch Pipe Outlet in 6 Easy Steps

WITH Bonney WeldOlets, ThredOlets and Socket-End WeldOlets you can speed up installation of new piping systems . . . make new branch outlets in existing systems faster than any other way, in many cases without even removing the main pipe. Any right-angle, welded branch pipe outlet can be made in 6 easy steps with these fittings . . . a stronger, better outlet obtained than with any other method. Here's how it's done.

1 Select the position of the outlet. Rub the fitting over the pipe several times at the position of the outlet to remove scale and dirt. Then mark center lines and tack into position.

2 Tack in a sufficient number of places to insure its desired position. No clamps are necessary. Then weld, following and filling the bevel along the base of the fitting. A junction of full pipe strength results.

3 Then remove the button with the torch, a hole saw or by drilling. Where the outlet is smaller than 2" . . . or under unusual conditions on the larger sizes, the fitting should be used as a templet and the hole cut in the main pipe first.

4 After the fitting is installed on the main pipe and the button removed, the inside of the joint is in full view for inspection . . . impossible with a junction made in any other way . . . or with any other type of fitting. Icicles, scale and excess welding metal are eliminated. They are removed with the button.

5 The branch pipe is then attached to the outlet of the fitting . . . by welding, if a WeldOlet or Socket-End WeldOlet is used . . . or simply screwed into position if a ThredOlet is used.

6 The job is then complete. Note the trim, mechanical appearance. A leakproof junction of full pipe strength has resulted without the use of templets or complicated forming and fitting.

WELDOLET

THREDOLET

Socket-End WELDOLET

WeldOlets, ThredOlets, Socket-End WeldOlets . . . because of their patented design . . . improve flow conditions, reduce turbulence and friction to a minimum.

Made of drop forged steel, they are available from stock for all standard pipe sizes for every type of piping installation and for all commonly used pressures and temperatures. Also furnished on special order in Toncan Iron, wrought iron, Monel, Everdur, etc. to meet special conditions. Bulletin WT-31 . . . just off the press . . . tells all advantages . . . is yours for the asking. Write for a copy today.

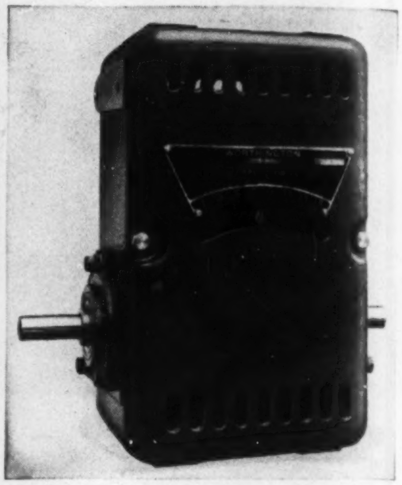
Bulletin WT31 - a 16 page catalog covering every feature of these fittings in complete detail and showing many of the various types of installations.

BONNEY FORGE & TOOL WORKS
FORGED FITTINGS DIVISION
ALLENTOWN, PA.

The unit is powered by a heavy duty ball bearing motor equipped with overload protection. The exhauster can easily be converted into a ventilator by changing the position of the tube adapter which is part of the equipment. One to six of the nozzles can be used as desired. Caps are provided for all nozzles not in use.—Chelsea Fan & Blower Co., 1206 S. Grove St., Irvington, N. J.

Variable Speed Drive

No. 2358—A new variable speed, multiple v belt drive is called the "Allspeed drive." The first of these to be made available has a horsepower range of from 1/3 to 3/4 hp with a speed ratio of 16 to 1; that is, any speed from 1/8 to twice the driving motor speed. This drive is said to be exceptionally compact, ball bearing equipped, and so designed that it can be operated in any plane. Further, it can be directly coupled to any standard motor and the output shaft can be run at motor speed, and is flexible enough to be applied to any type of machine within its power range.

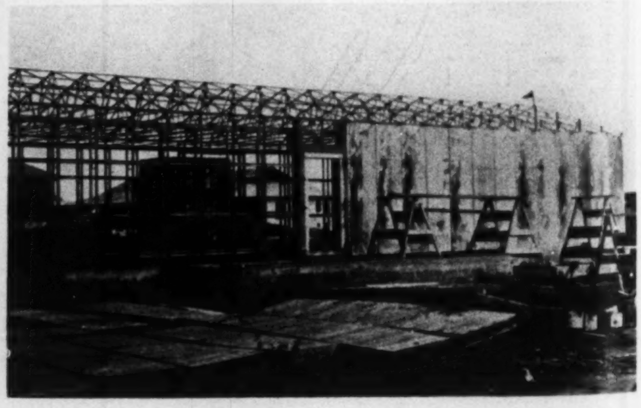


An interesting feature of this drive is its mechanical belt tensioning device which automatically compensates for increased arc of belt contact which results from changing from low to high speeds. In this tensioning device no springs are required. A further feature is the fact that the drive need not be dismantled to change belts.

According to the manufacturer other sizes are now being developed for 1 to 3 hp, 3 to 5 hp, 5 to 7¼ hp, and 7½ to 10 hp.—Worthington Pump and Machinery Corp., Harrison, N. J.

Food Storage in Tropics

No. 2359—Porter house steak in the heart of the African jungle is not "black magic" but a real possibility for Pan American Airways' pilots and crews. Refrigerator buildings which can be flown by plane to inaccess-



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OIL BURNING SYSTEMS

are only available—"for duration", on orders carrying high preference ratings.

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Petro service, parts for necessary maintenance, and engineering consultation and services, are still fully available.

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hundreds of Petro Oil Burning Systems are meeting unprecedented steam demands in war production plants everywhere;

—24 hour operation, far above normal ratings, day after day, week after week;

—a "break down" test on a gigantic scale which Petro equipment is meeting efficiently, economically, reliably, and without breaking down because ample reserve strength and wear has always been built into Petro.

In addition to being proud of such performance, we think it is a good thing for the heating trade to remember against the time when conditions again permit the free selection and installation of normal industrial and commercial firing equipment.

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Makers of Good Oil Burning Equipment Since 1903
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Your mill supply distributor calling. Here's a valuable tip. Write today for your copy of a new reference manual on Bronze and Forged Steel Globe and Check Valves for hydraulic service. It's just published by Watson-Stillman. Learn about many new valves never offered to you before.

28 PG. FACT-CRAMMED MANUAL OF BRONZE AND FORGED STEEL GLOBE AND CHECK VALVES!

Answers engineering questions. Packed with practical help. Pictures valves accurately. Shows sectional views. Gives dimension tables, specifications, in fact all the help you need to get the right valves for your hydraulic service.

Many new valves, widen the scope of Watson-Stillman products, give this book UNUSUAL TIMELINESS. Remember, too, that this just-completed line of valves, engineered by Watson-Stillman, backed by 94 years of W-S experience, is now available through mill supply distributors along with W-S Fittings, Hydraulic Hand Pumps and Jacks.

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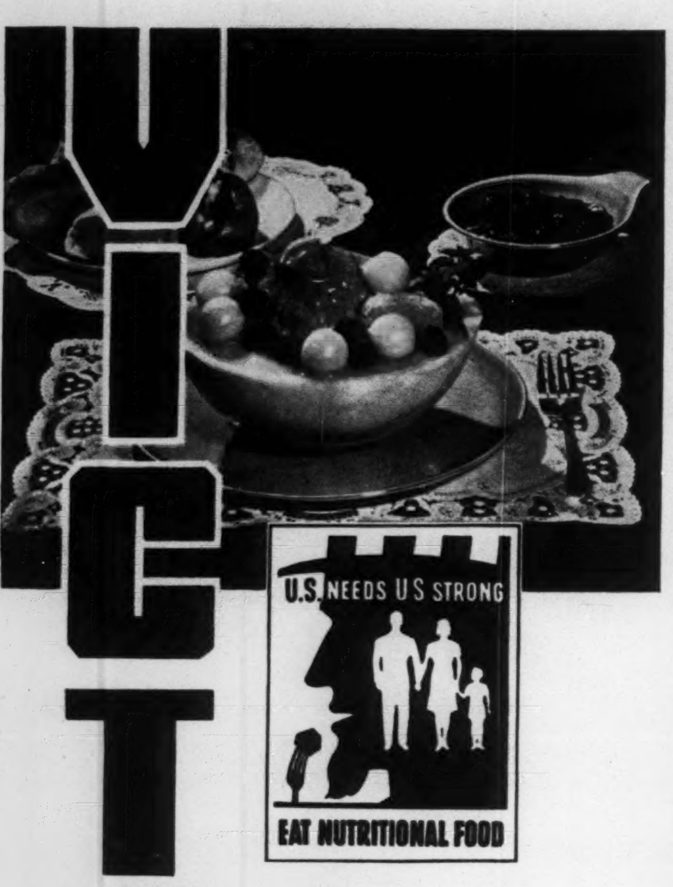

Helping
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Eating nutritional foods under Uncle Sam's nation wide drive for better nutrition, is easy today.

Refrigeration, Dependably Controlled with A-P Valves, enables Americans to have *all* the keen, stimulating, appetite-arousing tang out of their nutritional foods by keeping them fresh in transit and in storage.

Keeping present refrigeration equipment operating at peak efficiency for Wartime Food is a pledge Servicemen and A-P Valves can handle easily.

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AP DEPENDABLE *Refrigerant Valves*

ible locations provide storage for fresh and quick frozen foods at tropical bases. The buildings, which are equipped with refrigerating units, can maintain temperatures as low as zero in climates where the thermometer soars up to 130 in the shade.

By the adoption of prefabricated "Lindsay Structure," and a special device developed for wall spacers, it was possible to design buildings which met the necessary requirements. This structure is a light steel, pre-stressed panel type of construction.

The buildings were designed to be shipped knocked down as a package complete with equipment. Shaer & Turner Engineering Co., working in co-operation with the Airtemp division of Chrysler Corp., designed and built special wall panels to fit in the walls. These panels carry, on opposite sides, the hermetically sealed compressor and the air handling unit. All operating units were piped and wired before they were crated for shipment. No mechanical work was necessary on the job, except for hooking up to water and power supply sources.

The buildings were assembled in out-of-the-way locations in three weeks each, employing 15 unskilled natives under one supervisor. The buildings are approximately 78 ft long, 21 ft wide and 8½ ft high, inside dimensions. They are of double wall construction which permits an unbroken zone of insulation. Eight inches of "Dry-Zero" insulation is used in walls, roofs, and floors.—Dry-Zero Corp., Merchandise Mart, Chicago, Ill.

Balancing Machine

No. 2360—A new small bench model "Dy-Namic" balancing machine has a weight capacity range from 4 oz to 16 lb, an arbor range to $\frac{11}{16}$ in. diameter, and a 12 in. width capacity between supports. It has been designed to meet the need for precision balancing of small rotating bodies, such as blowers, wheels, small armatures, gears, pulleys, etc. According to the manufacturer, it is ideal for balancing motor generator armatures for radio transmission and signal corps work.

This model is one of an extensive line of balancing machines.—Bear Mfg. Co., Rock Island, Ill.

Plastic Tubing and Fittings

No. 2361—A line of chemically resistant plastic tubing and fittings in diameters from ⅛ to ¾ in. is offered by the manufacturer for the replacement of stainless steel, brass, aluminum, tin, copper, nickel, and rubber. This tubing is made of "Saran," a thermoplastic specially made to replace strategic materials.

Molded flare type fittings are available up to and including ½ in. OD, making it possible to install a complete system with no other tools than a sharp knife and a screw type flaring tool. Among the services for which the tubing is offered are water, gasoline, oil, acid, gas and air, as well as refrigeration.—Hodgman Rubber Co., Framingham, Mass.

Grease Collection from Ducts

No. 2362—A national campaign to salvage waste fats is now on and the need for these fats is daily growing more acute. A service for collection of exhaust fats to be converted to war uses and to fireproof and greaseproof

WHITLOCK

PREFABRICATED PIPING

Whitlock Pipe Bends, Headers, Flanged Joints, etc., have been widely used for years and for many services. As illustrated, pipe bends can be supplied in practically any shape and in a wide range of pipe sizes and bending radii—with plain ends, cast iron or steel flanges, and with screwed, welded, or Van Stone joints.

May we quote on your needs.

THE WHITLOCK MANUFACTURING CO.

44 South Street • Elmwood, Hartford, Conn.

DISTRICT OFFICES IN

New York • Chicago • Boston • Philadelphia
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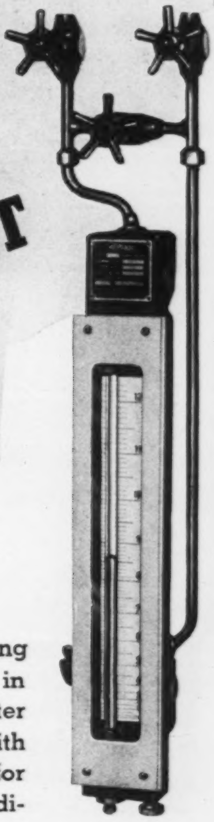
Accurate FLOW MEASUREMENT



★ The Meriam Type H Indicating Flow Meter finds extensive use in the measurement of cooling water in air conditioning systems. With it the cooling water flow rates for both summer and winter conditioning can be readily adjusted.

This meter may be permanently installed or used as a portable unit for making a complete survey of the system. The rate can be set so as not to pump more water than needed, affording substantial economies in pumping costs.

The meter operates in conjunction with an orifice plate installed in the flow line. The scale and the meter can then be graduated to read the flow in whatever units specified. If the operating line pressure does not exceed 250 lbs. per sq. in., this meter can be of valuable assistance in determining flow rates.

The same meter can be used to indicate the flow of steam, gas, and other fluids. It is furnished in either wall or flush front panel mountings. For complete details write for Bulletin 18.

THE MERIAM COMPANY

1985 West 112th St., Cleveland, Ohio

MERIAM

SINCE 1911

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MANOMETERS, METERS AND GAUGES FOR THE ACCURATE MEASUREMENT OF PRESSURES, VACUUMS AND FLOWS OF LIQUIDS AND GASES ducts in hotel and restaurant kitchens, is therefore of interest.

The grease accumulated in ducts and exhaust fans is not only hazardous, but reduces their efficiency. It is estimated that the average restaurant exhaust system yields anywhere from 25 to 300 lb of grease. Arrangements have been made with renderers to accept such greases to be salvaged for the war effort.—Chemical Service Corp., 110 S. Dearborn St., Chicago; 1015 Transportation Bldg., Detroit; or 6335 Hammel Av., Cincinnati.

Odor Adsorbers in Air Conditioning

No. 2363—An illustration of how, in the face of restrictions on air conditioning equipment, an existing system can be made to do a bigger job is found at the First National Bank building, Detroit. The principal complaint was that the air being distributed throughout the premises was odorous.

Examination disclosed that the air conditioning system was heavily overloaded. Even with no odors to cope with, it could not do a satisfactory job. Adsorber canisters were installed to remedy the problem. Six months have passed since the job was completed; according to the adsorber manufacturer, the odors are now eliminated from the air before it enters the enclosure, and a large percentage of this air after its entrance is recirculated again and again after it is made suitable for human consumption by a second passage through the carbon canisters. Recirculation reduces the load on the system. —W. B. Connor Engineering Corp., Dorex Div., 114 E. 32nd St., New York, N. Y.

Trade Literature

For your convenience in obtaining copies of these bulleti see coupon on page 121. If you write direct to the man facturer, describe carefully what literature you want, as th number given first in each item is for use only when sendi in your request to HEATING, PIPING & AIR CONDITIONIN

Air Conditioning and Refrigeration

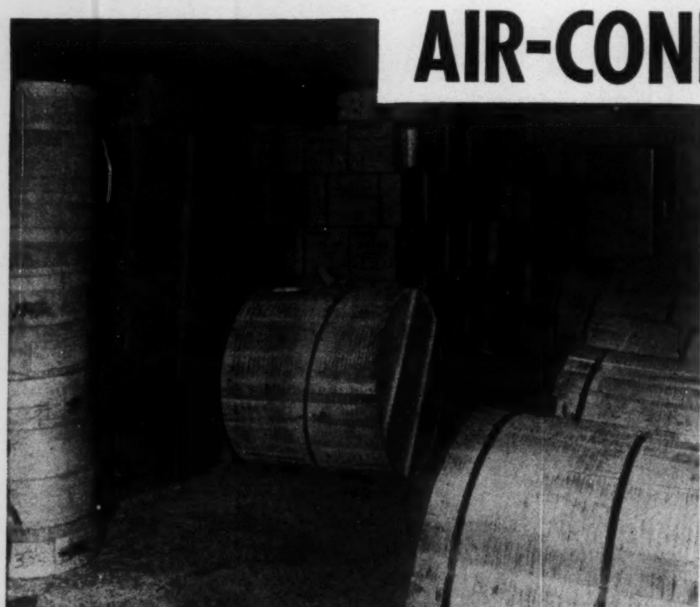
No. 4264—4 p. bulletin describing the manufacturer's air conditioning and refrigeration products, illustrating equipment and installations, and giving a temperature scale showing the temperatures used in various air conditioning and refrigeration processes.—Frick Co., Waynesboro, Pa.

Air Eliminators and Equalizing Valves

No. 4265—4 p. bulletin (112) on equalizing valves and air eliminators for one pipe and two pipe steam systems and for radiators, risers, and mains.—Gorton Heating Corp., Cranford, N. J.

Balancing Machines

No. 4266—Looseleaf catalog on "Dy-Namic" balancing machines for precision balancing of rotating parts such as fans, wheels, gears, armatures, etc. Information on importance of balancing in eliminating noise and wear due to excessive vibration is included.—Bear Mfg. Co., Rock Island, Ill.



AIR-CONDITIONED STORAGE

with the NIAGARA *No Frost* SYSTEM* maintains High Quality in Perishable Foods

By maintaining constant, full capacity, never decreased by progressive icing of refrigerant coils, the Niagara "NO-FROST" System produces at all times rapid, uniform cooling of products freshly put into storage... resulting in higher quality of eggs, butter, cheese, produce, and other foods.

Niagara equipment includes: dry coil fan coolers, disk fan coolers, spray coolers, "No-Frost" Systems, precise control air conditioning.

Write for Bulletin #83

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NIAGARA INDUSTRIAL COOLING • HEATING • DRYING
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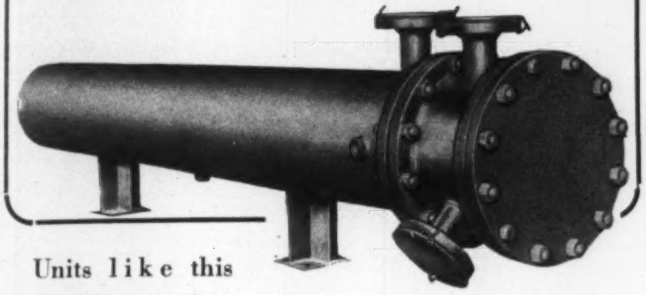
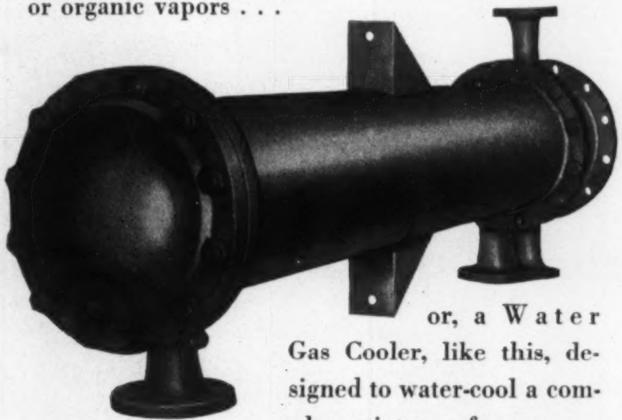
IF YOU WANT A
GOOD
HEAT EXCHANGER—



Units like this Flash-Steam Condenser, used for the heating of water, brine, oil or chemical solutions . . . for condensing of flash steam in blowdown systems . . . for refrigerants or organic vapors . . .



or, a Water Gas Cooler, like this, designed to water-cool a complex mixture of gases . . .

Or, an Instantaneous Water Heater, a Quench Oil Cooler, Cutting Oil Cooler, Fuel Oil Heater, Vapor Condenser . . . All are best engineered by a *specialist in design and fabrication for heat transfer work.* Such an organization is DOWNINGTOWN . . . Widely experienced, thoroughly competent, specially tooled for economical fabrication of this type of work.

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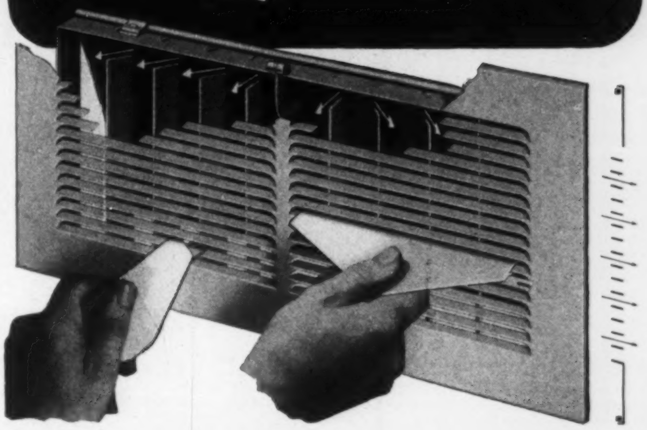
DOWNINGTOWN, PA.
WELDED and RIVETED PRODUCTS

SINCE 1913, FABRICATORS OF HIGH QUALITY STEEL and ALLOY PRESSURE VESSELS

INDEPENDENT
Air Conditioning Registers



No. 439 Meets Every Requirement
FOR DEFENSE HOUSES

This improved register affords the widest latitude in deflecting air flows four ways. Valve opens complete 90 degrees to admit full flow of air from horizontal air duct. Simple, modern design conserves material and presents handsome appearance. And equally important, it is moderately priced to give big value. Made in sizes to meet all standard requirements. Send for catalog.

HORIZONTAL GRILLE BARS, formed in the wrought steel face, are set to deflect air flow about 15 degrees downward. Being flexible, they may be bent, before or after installing, to direct the air flow to any other angle upward or downward, or straight outward.

VERTICAL DEFLECTING VANES attached to the back of the register face direct the air flow straight outward in the center, 30 degrees right and 30 degrees left—the arrangement required for most installations.

These deflecting vanes also are flexible and may be set to direct the air flow all right, all left, or any combination of directions.

Grille bars and deflecting vanes are easily adjusted with tool accompanying each shipment.

Always leading. Always progressing. 42C

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BARBER-COLMAN COMPANY

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Blowers

No. 4267—12 p. performance data folder (65) on general purpose, single inlet blowers, direct or belt driven, for supplying or exhausting air. Performance data on three different series in a wide range of wheel diameters are given.—Lau Blower Co., 2001 Home Ave., Dayton, Ohio.

Butterfly Valves

No. 4268—4 p. folder on precision machined and wedge tight butterfly valves, 150, 300, and 600 psi cast steel. They have sufficient face to face dimensions to permit the mounting of ball bearings for high pressure service. Complete tables of dimensions with raised face or ring joint flanges are included.—R-S Products Corp., Germantown Ave. at Wayne Junction, Philadelphia, Pa.

Direct Fired Heaters

No. 4269—12 p. bulletin (506) on direct fired heaters, featuring savings in critical materials, transportation, and time. Tabulations are included which cover comparative savings in metals, by weight and monetary cost, and there is information on oil, gas, and coal fired models as compared to central steam plant heating.—Dravo Corp., Neville Island, Pittsburgh, Pa.

Employees' Manual

No. 4270—72 p. illustrated booklet, pocket size, prepared in order to give information to new employees and covering employment, health and safety, information for the employees' benefit, general information, and information about the company.—Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Engineering, Design, Construction, Supervision

No. 4271—118 p. profusely illustrated booklet covering industrial, commercial, and institutional projects and giving a partial list of clients as well as illustrations of typical buildings. Plants in many industries are included, with interesting data on outstanding design features.—Lockwood Greene Engineers, Inc., 10 Rockefeller Plaza, New York, N. Y.

Flow Meters

No. 4272—56 p. catalog (3010) on flow meters, describing the manufacturer's complete line and in addition to covering electric, mechanical, area, ring balance, liquid level, and weir meters, information is also given on a new two pen electric flow recorder with ratio indicating pointer, an improved low pressure electric type meter, and an ultra high pressure (6000 psi) ring balance meter. With many illustrations, the catalog also includes a discussion of flow metering benefits and gives a complete listing of specifications and ranges.—Cochrane Corp., 3161 N. 17th St., Philadelphia, Pa.

Glass, Paint, and Chemicals

No. 4273—24 p. "jubilee issue" of the publication Pittsburgh Plate Products, tracing the history of the company's advertising and production activities over the past half century. One of the articles featured "Foamglas", a new insulation which has many applications.—Pittsburgh Plate Glass Co., 2000 Grant Bldg., Pittsburgh, Pa.

Here's why ROCK CORK Delivers LASTING INSULATING EFFICIENCY

Basically mineral, this time-tried J-M Material provides these five essential features in every refrigerated service . . .

1. RETAINS LOW CONDUCTIVITY
2. DOES NOT ABSORB ODORS
3. THOROUGHLY SEALED AGAINST MOISTURE
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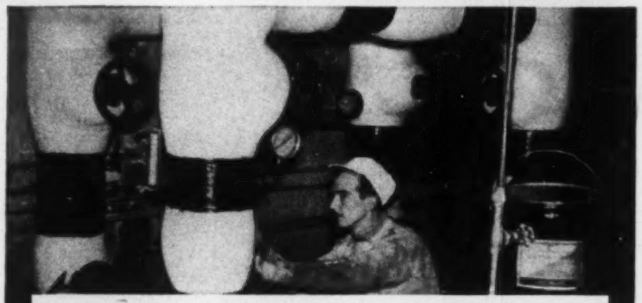

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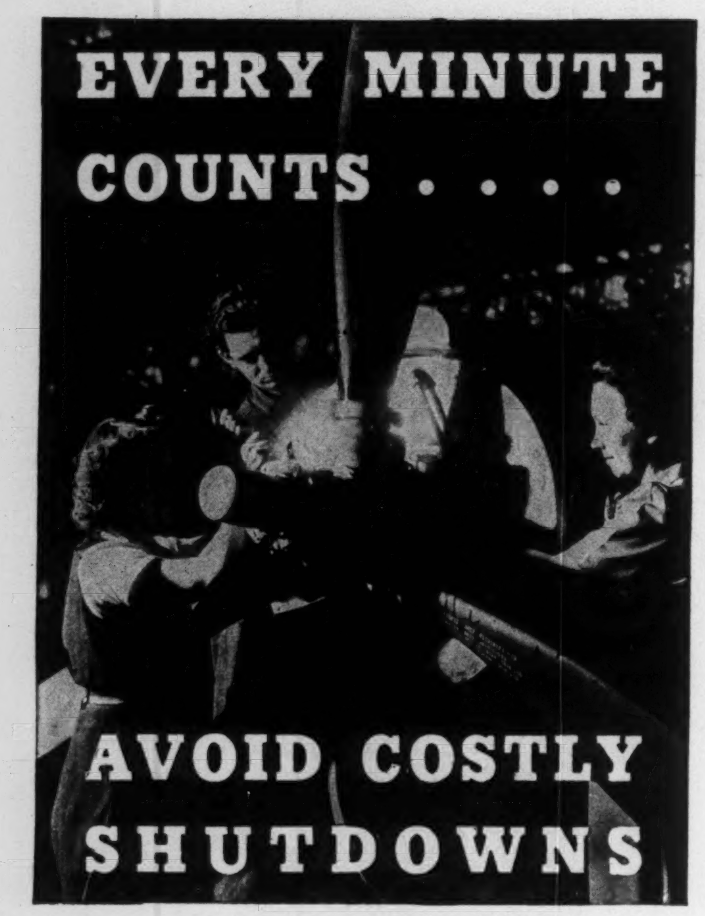

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Instruments

No. 4275—48 p. catalog (95-A) describing the manufacturer's full line of instruments for the measurement and control of industrial process conditions. Temperature, flow, pressure, level, and humidity instruments are covered and information is given on valves, panels, and similar subjects.—Foxboro Co., 106 Neponset Ave., Foxboro, Mass.

Instruments

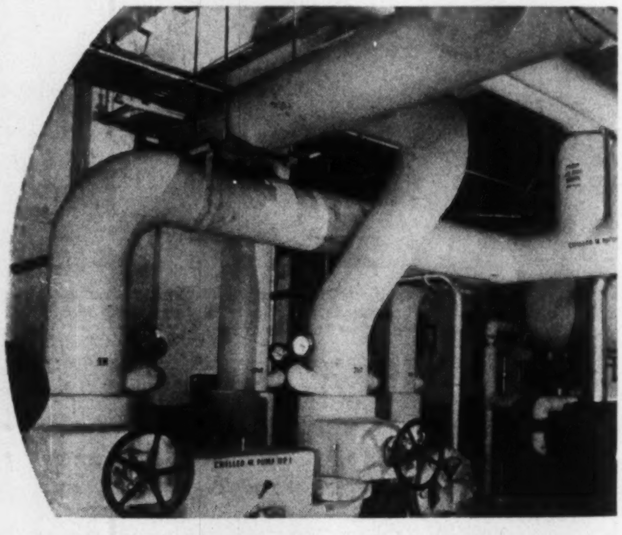
No. 4276—12 p. catalog (4120) on round and square panel instruments for alternating and direct current in 3 in. and 4 in. sizes.—Roller-Smith Co., Bethlehem, Pa.

Motor Operated Valves

No. 4277—Price sheet (F-1786) on direct current motor operated valves for two position control in sizes ½ to 2 in., giving information on applications (including heating and cooling coils, humidifiers, boiler feedwater control, hot water storage tanks, etc.), construction features, specifications, sizes, and prices.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Piping Design

No. 4278—Six sheets to insert in the manual, Design of Piping for Flexibility with "Flex-Anal" Charts, pre-



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Plastic Pipe

No. 4279—8 p. booklet presenting information on "Saran" thermoplastic pipe with information on chemical resistance, welding the pipe, elbows and tees, flanges and other fittings, the pipe sizes available, and the properties of the thermoplastic resin from which this pipe is made.—Dow Chemical Co., Midland, Mich.

Plywood

No. 4280—Catalog of industrial and manufacturing uses of fir plywood and a handbook of plywood technical data for engineers and architects, intended to fill the need for detailed information on this product which has gained new importance in the production and shipment of war goods and as a load bearing structural material. The technical handbook contains sections on physical characteristics, designing plywood, and prevention of condensation in walls. The industrial handbook is a collection of selected articles telling of new and significant applications, among which are included dehydrating plants.—Douglas Fir Plywood Association, Tacoma Bldg., Tacoma, Wash.

Preheating Chart

No. 4281—Preheating chart for wall mounting which covers correct preheat temperatures and other pertinent

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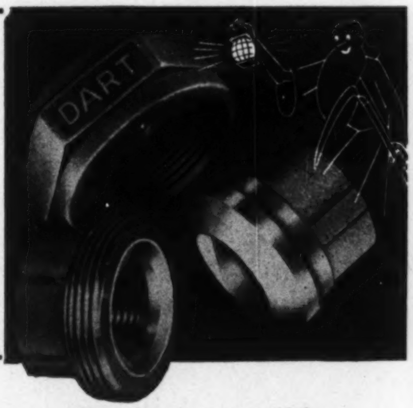

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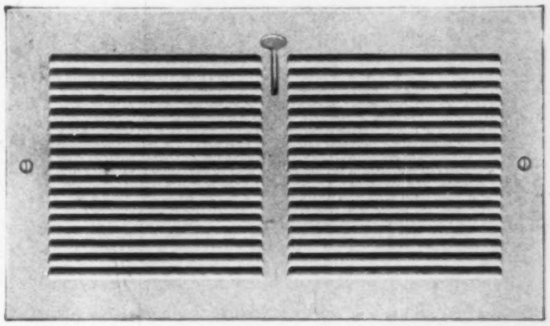

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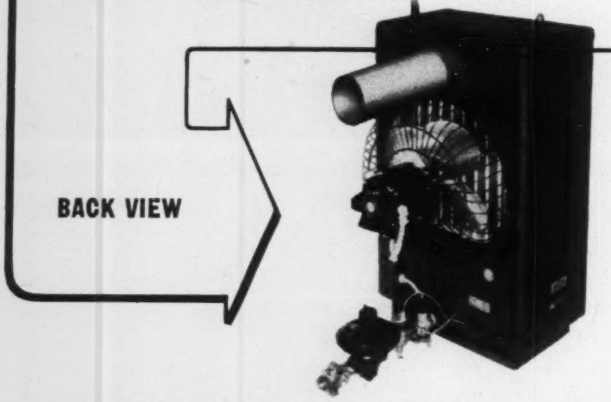

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No. 4282—24 p. booklet discussing production facilities for ferrous or nonferrous metals of the manufacturer, illustrating and tabulating plant equipment with detailed information about it.—United States Register Co., Burnham St., Battle Creek, Mich.

Rheostats

No. 4283—16 p. bulletin (60A) covering pressed steel rheostats with solid rectangular contacts for providing fine degree of control, smooth operation, and economies where interpolating rheostats would otherwise be required.—Ward Leonard Electric Co., 37 South St., Mt. Vernon, N. Y.

Rubber Guide Book

No. 4284—30 p. rubber guide book for American war industries, listing applications and properties of many types of products for industrial and aeronautical purposes using natural, synthetic, or reclaimed rubber. Extensive data on applications and properties of the various products are presented. One of the most pertinent chapters in the synthetic rubber section is that devoted to the properties of "Ameripol" compounds used in handling aromatic, Asiatic, or loaded fuels.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

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No. 4285—16 p. bulletin devoted to automatic reduced voltage starters for squirrel cage motors containing a complete discussion of the factors that enter into the selection of such starters and including descriptions of automatic resistance starters in various types and sizes.—Allen-Bradley Co., 1335 S. First St., Milwaukee, Wis.

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No. 4286—Combination bulletin and price sheet describing manual starting switches for motors rated to 1 hp, 110-220 volts a-c, and ¾ hp, 115-230 volts d-c. These compact switches are designed for starting and overload protection of small motors used in unit heaters, stokers, refrigeration machines, fans, pumps, compressors, etc.—Allen-Bradley Co., 1335 S. First St., Milwaukee, Wis.

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No. 4287—22 p. catalog of instant steam generators and accessory equipment, including information on the "packaged steam" generator, types of valves, traps, metallic joints, thermostatic controls, motorized valves and dampers, heat exchangers, alarms, and thermostats. Typical layouts are given showing uses of the generator.—Vapor Car Heating Co., Inc., 80 E. Jackson Blvd., Chicago, Ill.

Steels

No. 4288—Technical data card (TDC-119) featuring the combined list of standard steels of the American Iron and Steel Institute, and the Society of Automotive Engineers.—Babcock & Wilcox Tube Co., Beaver Falls, Pa.

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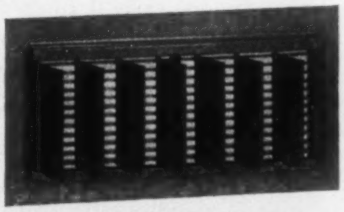

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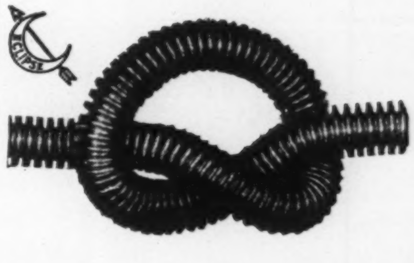

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Unit Heaters

No. 4289—8 p. catalog on new "Grid" cast iron un heater containing capacity tables for six models, typic hookup diagram, dimension diagram, and details of co struction.—D. J. Murray Mfg. Co., Wausau, Wis.

Valve Repairs

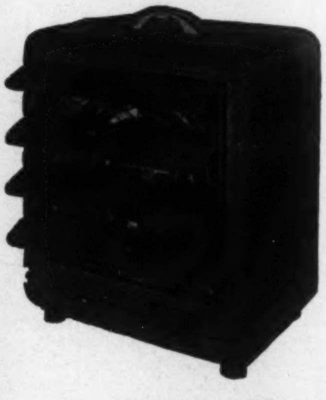
No. 4290—6 p. bulletin of piping pointers, No. 5 o a series, explaining and illustrating the various steps t take in repairing leaky gate and globe valves and givin hints on how to reclaim discarded valves. The subjec is most timely in these days when valves, like other pipin materials, are not always easy to obtain.—Crane Co., 83 S. Michigan Ave., Chicago, Ill.

V Belt Care

No. 4291—16 p. booklet of plain facts on wartime car of rubber v belts discussing the principle of the v belt drive, and including "post mortems" on actual damage v belts. How to obtain proper tension, what to do abou worn sheaves, and what determines the life expectancy o belts are among the topics discussed.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Water Heaters

No. 4292—4 p. catalog (TW-956) on "Tabasco" steel welded water heaters rated to heat 130 to 700 gph of 50 F water. A diagram of typical piping connections to a storage tank is included.—Kewanee Boiler Corp., Kewanee, Ill.



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Water Softeners

No. 4293—6 p. bulletin (W-212-B2) on hot process water softeners, discussing and diagramming the construction features and illustrating various parts.—Worthington Pump & Machinery Corp., Harrison, N. J.

Welding

No. 4294—36 p. bulletin describing "Castolin" eutectic low temperature welding, a new joining process for use with oxyacetylene, gas torches, metallic arc, carbon, induction, resistance, and furnace welding. The booklet is entirely devoted to the war effort, either in connection with production or salvaging of machinery and tools.—Eutectic Welding Alloys, Inc., 40 Worth St., New York, N. Y.

Useful Information

Method for Developing Specifications for Building Construction

Report BMS87 of the National Bureau of Standards discusses a method for developing specifications for building construction. It comprises a report of the subcommittee on specifications of the central housing committee on research, design, and construction and is available from the Superintendent of Documents, Washington, D. C., for 10c.

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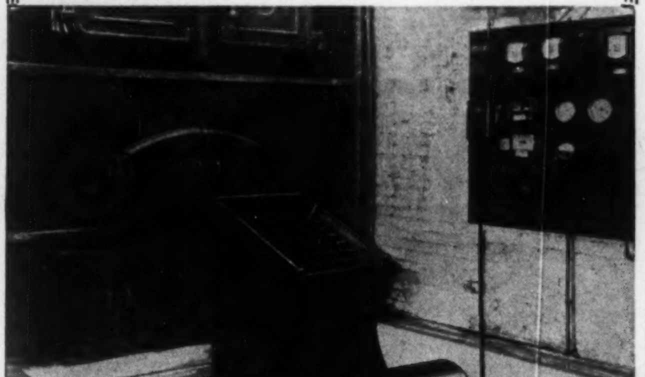

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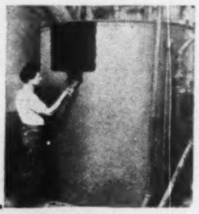

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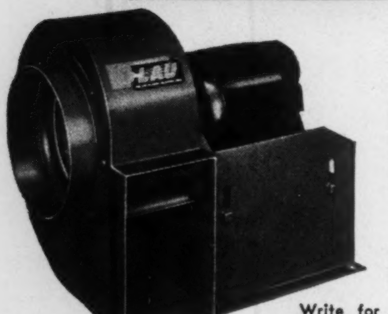

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attempt to reduce the time and labor now consumed in their preparation, a representative committee of federal agencies has made a study of current specification writing routine. In its report, this committee advocates a directive method which, under proper supervision, should condense specifications, bring about important economies, and increase efficiency.

Fundamental principles that have proved of value over a period of years have been retained and are coordinated in a basic specification which promotes uniformity and permits choice of those materials and methods of construction best suited to the specific project in hand.

Information on this method, a form of specification devised by Horace W. Peaslee, is given in an article on p. 758 of the December, 1941, HPAC.

Instruction of Welding Operators

The American Welding Society has recently approved and published a new tentative standard entitled Code of Minimum Requirements for Instruction of Welding Operators, Part A—Arc Welding of Steel $\frac{3}{16}$ to $\frac{3}{4}$ In. Thick. This code represents a revision of the proposed code that was issued by the society in 1941 and given wide circulation. The latter was adopted and reprinted by the War Production Board for use in defining an "accredited school."

In the process of revision, the code was considerably expanded, particularly with respect to the supplementary material given in the appendices as suggestions to persons organizing courses in metal arc welding. The sections in the main body of the code include: equipment and facilities of the school, qualifications and duties of the instructor, instruction in welding practice, instruction in welding theory, and final tests. There are nine appendices of suggested and recommended material, as follows: suggested accessory equipment for welding school, recommended design of positioning equipment, recommended designs of testing apparatus and their application, recommended safety rules for student arc welding operators, welding electrodes, suggested arc welding exercises, suggested form of student progress chart, recommended form for record card, and annotated selected bibliography of publications relating to arc welding instruction.

This 68 p. booklet is available at 50c a copy from the American Welding Society, 33 W. 39th St., New York, N. Y.

Coming Events

Welding in War Production

American Welding Society: Annual meeting, October 12-16, Hotel Cleveland, Cleveland, Ohio, in conjunction with National Metal Exposition to be held in Cleveland Public Auditorium the same week. Theme of the meeting will be welding in war production, and technical sessions will include welding of aircraft, ships, tanks, and ordnance materiel; training welding operators and qualification; localized heat treatment; residual stresses and their relief; weldability of steel; gas cutting; resistance welding fundamentals; brazing and soldering; structural design; and non-destructive tests and inspection. Headquarters office of the AWS is at 33 W. 39th St., New York, N. Y.

Mechanical Engineers

American Society of Mechanical Engineers: Fall meeting, October 12-14, Sagamore Hotel, Rochester, N. Y. Among the papers scheduled for presentation are the effect of wood structure upon heat conductivity, by Frederick F. Wangaard; performance of rod curtain type electrostatic precipitators, by Irvin G. McChesney; the elastic properties of curved tubes, by Irwin Vigness; process lags in automatic control circuits, by J. G. Ziegler; and handling scrap after it has been produced, by Robinson D. Bullard. Headquarters office of ASME is at 29 W. 39th St., New York, N. Y.

Health of War Workers

Industrial Hygiene Foundation: Annual meeting, November 10-11, Mellon Institute, Pittsburgh, Pa. Theme of the meeting is to be "Health Arms the War Workers." Among the practical measures urged by the foundation are immediate audits and analyses of absences to determine the amount of time lost from illness and non-industrial injuries, the cause and location; immediate industrial hygiene surveys to locate and eliminate hazards, such as chemical fumes, dusts, etc., endangering the health of workers; modern medical departments within industry, ably staffed and armed with authority to direct employee health protection in all phases. This plan of action will be amplified at the meeting. Headquarters office of the foundation is at 4400 Fifth Ave., Pittsburgh, Pa.

Chemical Exposition

National Chemical Exposition: November 24-29, Hotel Sherman, Chicago, Ill. Sponsored by Chicago section of American Chemical Society. Manager of the exposition is Marcus W. Hinson, 110 N. Franklin St., Chicago.

Power Show

15th National Exposition of Power & Mechanical Engineering: November 30-December 5, Grand Central Palace, New York, N. Y. According to the management, exhibitors are planning displays that will help the war production program by showing how to get more out of existing equipment, and ways and means of preventing shutdowns and insuring continuous operation. Under management of International Exposition Co., Grand Central Palace, New York, N. Y.

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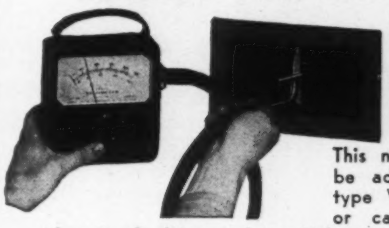

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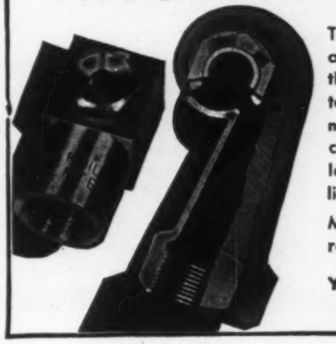
YARWAY INVOLUTE NOZZLES

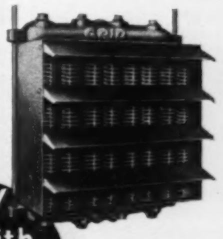


The preference for trouble-free air washing service — because there are no internal parts or vanes to wear or clog. Proven through many years of service in water cooling and air conditioning installations totaling more than 5 million g. p. m.

Made in sizes and types for all requirements. Ask for Bulletin N-615.

YARNALL-WARING CO., PHILA.
107 MERMAID AVENUE

IT'S STILL A DIFFERENT UNIT HEATER



Cast iron takes the place of aluminum for the heating sections, to cooperate with the war effort in using substitute materials—but it's still the ultimate in unit heater quality.

The new Grid is engineered along the same lines as the Grid Unit which had aluminum heating sections — dependable, long life unit. Patent applied for. No corrosion—no leaks or breakdowns . . . In this new Grid Unit there is only one type metal in contact with steam or hot water. There is nothing to cause electrolysis that produces corrosion. Engineered and constructed to withstand up to 250 lb. steam pressure.

NOW made with CAST IRON Heating Sections

D. J. MURRAY MFG. CO.
Wausau, Wis.

GRID UNIT HEATER

CLASSIFIED ADVERTISING

8 cents for each word including heading and address. Count nine words for keyed address. Minimum $2.00 for each insertion. One inch $4.00. Cash must accompany order. Copy must be in our hands by the twenty-fifth of the month previous to issue.

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AIR CONDITIONING FOR COMFORT
Third Edition—285 Pages—$2.00
An exhaustive and clear treatment of the subject of air conditioning. Covers psychrometry, humidifying, dehumidifying, mechanical refrigeration, heat transmission, air volumes, infiltration, air distribution, water circulation, etc. An invaluable reference book that belongs in the hands of everyone interested in or doing air conditioning work. Order from Keeney Publishing Co., 6 North Michigan Ave., Chicago, Ill.

MISCELLANEOUS

If you're looking for a position, or need a dependable man to fill one use Heating, Piping and Air Conditioning Classified Advertising for quick results. It puts you in direct touch with the men who count in the heating, piping and air conditioning industry.

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THE EDITOR'S PAGES

1942 MARKS CENTENNIAL OF HOT WATER HEATING

Amid the turmoil of war, the fact that the year 1942 marks the 100th anniversary of the introduction of hot water heating in the United States has almost escaped attention, the Plumbing and Heating Industries Bureau points out.

Joseph Nason, a New England engineer, brought the Perkins system of hot water heating from England in 1842. Two of the earliest installations in the United States were made in the counting room of the Middlesex Mill in Lowell, Mass., and in the Eastern Exchange Hotel of East Boston. The latter is believed to be the first hotel in America heated with hot water.

The Perkins system of hot water heating as used in England a hundred years ago consisted simply of a boiler, and pipe coils installed in the rooms to be heated. There were no valves to control the flow of the water. The circuit of the water was continuous from the boiler, through the coils in the different rooms, and back to the boiler.

All of the pipe for the earliest installations of hot water heating in America was imported from England. The first radiators were made about 1860 and consisted of rows of wrought iron pipes screwed into a cast iron base.

FILE CRIMINAL CHARGES AGAINST DEALER

The Department of Justice recently announced the filing of criminal charges against the two members of the partnership and an employee of a firm dealing in air conditioning and refrigerating equipment, alleging violations of the Second War Powers Act. The proceeding was instituted by an information filed by leave of court. The charges are in 10 counts, each count alleging that the defendants knowingly, wilfully, and unlawfully sold and delivered unused refrigerating and air conditioning equipment when such sale was prohibited by general limitation order L-38 of the War Production Board. This order was issued as a war measure to conserve the supply of critical materials required for the prosecution of the war, particularly iron and steel. Each of the 10 counts charges an illegal sale and delivery, the criminal penalty for which is prescribed by the Second War Powers Act, and carries a maximum penalty of one year in jail and a fine of $10,000.

The case was instituted by the antitrust division of the Department of Justice upon recommendation of John Lord O'Brian, general counsel of the War Production Board, based on investigation made by the WPB regional compliance unit in Philadelphia.

INCREASES WORK SPACE WITHOUT CRITICAL MATERIALS

How to get additional war production space without using critical materials for building a plant addition was solved recently by the Ilg Electric Ventilating Co.

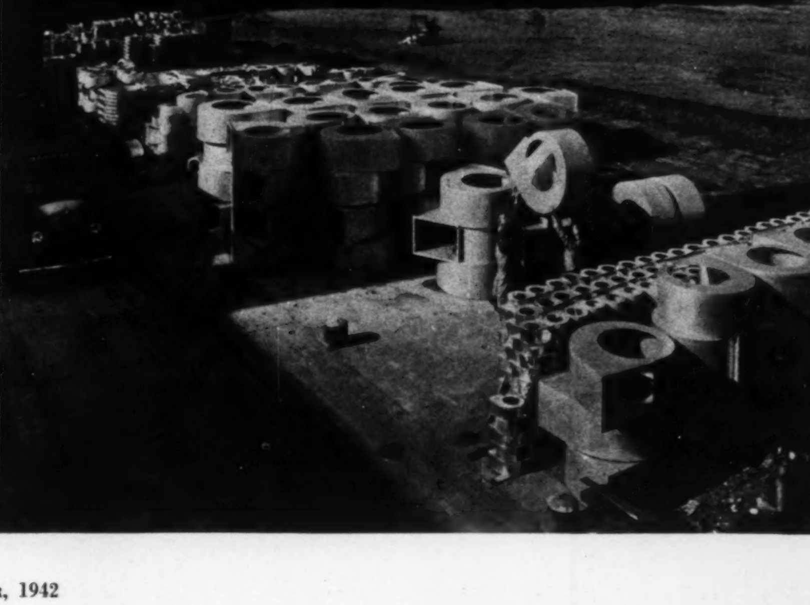
Faced with the double problem of capacity-taxing orders for heating and ventilating equipment, plus patriotic unwillingness to use scarce building materials for necessary plant expansion, engineers exercised their ingenuity and came forward with the solution of building an open air concrete storage space immediately adjacent to the plant.

The area west of the factory building had long been used as a "pitch and putt" miniature golf course for employees. Twelve thousand square feet was taken from one end of the golf course, leveled off, and given a concrete base which was, in turn, connected to the main plant by concrete runways. In the storage area so created, galvanized parts and blowers are stored until ready for assembly or shipment. Space inside the plant which would ordinarily have been used for storage purposes has been equipped with new machinery to further speed war production.

WILBER HEADS WPB HEATING BRANCH

Appointment of Joseph F. Wilber as chief of the plumbing and heating branch of the War Production Board was announced last month by A. I. Henderson, deputy director general for industry operations. Mr. Wilber is the proprietor of Hollis French, of Boston, consulting engineers. He succeeds W. W. Timmis who has been commissioned a lieutenant commander in the United States Navy.

Ronald Allwork, who has been acting chief of the plumbing and heating branch since Mr. Timmis resigned, will remain as deputy chief of the branch.



THE EDITOR'S PAGES

Continued

DR. GIESECKE AT U. OF I.

Dr. F. E. Giesecke, a member of HPAC'S board of consulting and contributing editors and former president of the American Society of Heating and Ventilating Engineers, has joined the staff of the engineering experiment station of the University of Illinois as a special research professor in mechanical engineering, cooperating in the research projects relating to hot water and steam heating. Dr. Giesecke will be at Urbana for a six months' period which began September 1.

The Institute of Boiler and Radiator Manufacturers and the ASHVE are both sponsoring hot water and steam heating research projects on which Dr. Giesecke will act as consultant.

MASS PRODUCTION OF ELECTRONIC WAR DEVICES

Electronics was geared to America's war machine on a mass production scale with the opening of new facilities of the Minneapolis-Honeywell Regulator Co. last month. The new plant is the first to go into volume production of new electronic devices for military aviation and other uses, which were developed and are being custom made in the company's other factories, said H. W. Sweatt, president. Adapting the operation to mass production methods required the skill of more than 300 engineers, it was stated, who did the job in three months.

STUDIES INDICATE HUGE SAVINGS WITH ARC WELDING

Air conditioning men figured prominently in the awards announced last month in the nationwide 2½-year $200,000 scientific welding study program sponsored by the James F. Lincoln Arc Welding Foundation. This industrial progress award program brought forth reports of welding progress prepared by executives, engineers, designers, architects, production officials, and others throughout the industrial field. The study indicated a possibility of tremendous savings in costs and man-hours for production of products by arc welding for both war and peace.

"Savings in critical materials and in production costs," said Dr. E. E. Dreese, chairman of the foundation, and of its jury of award, "reported available by arc welding in the award studies, assume such proportions as to be of vital national significance. The figures, based on representative products and structures, show a possible annual cost savings of $1,825,000,000. This includes 7,000,000 tons of steel valued at $271,000,000 and 153,000,000 man-hours of labor. This saving in man-hours will place the industrial manufacturer in a strong position to compete in future world markets."

In the air conditioning industry, amounts of the chief awards, the names, subjects, and connections of awardees are as follows:

$1,500, George W. Meek, formerly of Carrier Corp. Subject matter: Skyscraper air conditioning with arc welded conduit. With office buildings, size of ducts has made it advisable to use higher air pressures and welded ducts. Number 18 ga metal is used. At first, difficulties were experienced in obtaining this size metal in conduit form and also in welding it. The author gives the advantages of the conduit form over the duct form: increased floor space, saving in floor length, increased length of life, reduced fire hazard. The saving per unit is given as 26 per cent over the duct system.

$1,300, John F. Muller and Gonzalo C. Munoz, sales engineer and secretary-treasurer, respectively, American Pulley Co. Subject matter: Study of the best method of suspending the compressor of a railroad car air conditioning system. Detailed accounts of the design of both arc welded and riveted compressor suspensions, together with a close stress analysis of the frame, are given. Weight and cost data on both systems indicate savings of $17.11 per unit using arc welding.

$700, Wayne Buerer, assistant professor of mechanical engineering, Oklahoma Agricultural and Mechanical College. Subject matter: An experimental 7½ ton refrigeration plant for use in a college laboratory and provided with arrangements, such as thermometer wells, for measuring quantities which affect its operation. Arc welding was used for the greater part of the ammonia piping system. Instead of using elbows, the pipe was heated and bent to about 10 in. radius. The saving over threading was estimated as 27 per cent.

$250, R. M. Rush and H. A. Pietsch, Dravo Corp. Design and development of a direct fired heater for oil, gas, and coal firing.

$100, L. P. Skinner, Jr., assistant superintendent, Southern Acid and Sulphur Co., Inc. Subject matter: Elimination of flanged joints in the construction of fuming sulphuric acid coolers.

$100, William Simons, Dow Magnesium Corp. project. Subject matter: All welded ductwork for air conditioning system.

$100, Phil A. Celander, in charge of product design, Williams Oil-O-Matic Heating Corp. Subject matter: Arc welding heating units.

CHAMBERLAIN NAMED SALES MANAGER

Charles C. Chamberlain has been named as general sales manager of Jenkins Bros., manufacturers of valves and other products, according to announcement by Farnham Yardel, president of the company.

Mr. Chamberlain came to Jenkins in 1929, on graduation from Hamilton College.

SESSIONS APPOINTED CHIEF ENGINEER

Robert C. Sessions, of the consulting engineering firm of Sessions & Sessions, has been appointed chief engineer of the Brown Fintube Co. The firm of Sessions & Sessions is being continued under the active direction of Frank L. Sessions, senior partner.

◆ ◆ ◆

Theme of the American Industries Salvage Committee drive for dormant industrial scrap is: "If it hasn't been used for the past three months and if no one can prove it will be used in the next three—find a use for it *or scrap it*."

Equipment Developments

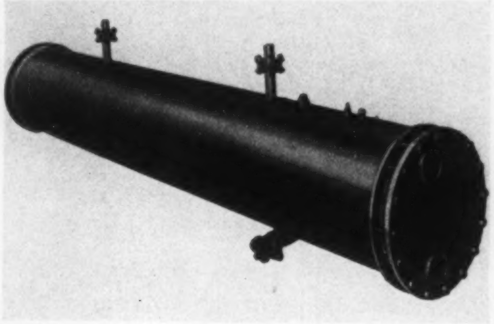
For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1942, HEATING, PIPING & AIR CONDITIONING *and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.*

Control Relay

No. 2364—The "Motorelay" is for use with any floating contact device in applications where the control current exceeds the contact rating of the control instrument. The device includes a shaded pole, reversible geared head motor, totally enclosed switches, and switching mechanism. An enclosed type drawn steel cover is available. Switch contacts have a non-inductive load capacity of 10 amperes at 110 or 230 volts a-c. Control circuit current is 0.35 amperes at 25 volts.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Water Cooled Freon Condenser

No. 2365—A new water cooled "Freon" condenser is built in 11 different sizes for a range of capacities from 5 to 100 tons each. It is constructed of a seamless steel shell and steel tubes, with a removable cast iron header which can be arranged for either series or parallel water flow. All prime surfaces with no fins permits removal and replacements of tubes if necessary. Tubes are rolled into tube sheets and soldered.



The unit is equipped with a ball type valve for purging noncondensable gases. The condenser is designed with a fusible plug with a melting point of 230 F.

Designed to conform with the unfired pressure vessel section of the ASME boiler construction code, each condenser is tested under 300 psi pressure, cleaned and dehydrated, then sealed with 30 psi pressure of dry inert gas before it is shipped from the factory, says the manufacturer.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

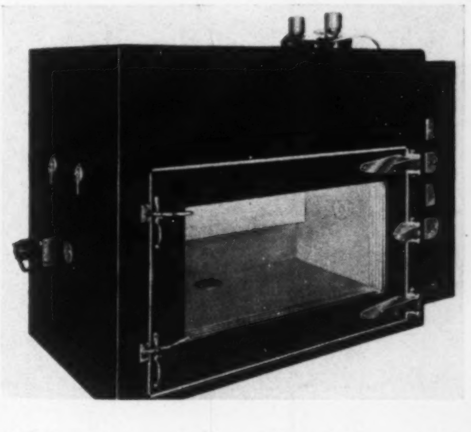
All Position Welding Electrode

No. 2366—A new electrode designed specifically for all position welding of mild steel with a-c type welding machines has been developed in diameters of ⅛ and 5/32 in. Made to fill a rapidly growing need for a high quality a-c electrode for all position use, the "Airco No. 230" electrode complies with all requirements of the American Welding Society classification E6011, American Bureau of Shipping, group H1G and B1G, for a-c and other specifications qualifying it for use on war work, the maker states.

A characteristic of this electrode is that average operators have no difficulty in securing good fusion and complete penetration, it is said. The finished weld deposit is quite smooth and has a uniform surface contour.—Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y.

Instrument Testing Chamber

No. 2367—Many precision instruments today must function equally well in chilly Iceland and sun-baked Libya. With such requirements in mind, a new chamber for testing instruments under extremes of cold and heat



[*Continued on p.* 123]

HEATING, PIPING & AIR CONDITIONING,
6 N. Michigan Ave., Chicago, Ill. [11-42]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Trade Literature. (*Circle each number in which you are interested*):

2364	2365	2366	2367	2368	2369	2370	2371	2372	2373
2374									
4295	4296	4297	4298	4299	4300	4301	4302	4303	4304
4305	4306	4307	4308	4309	4310	4311	4312	4313	4314
4315	4316	4317	4318	4319	4320	4321	4322	4323	4324
4325	4326	4327	4328						

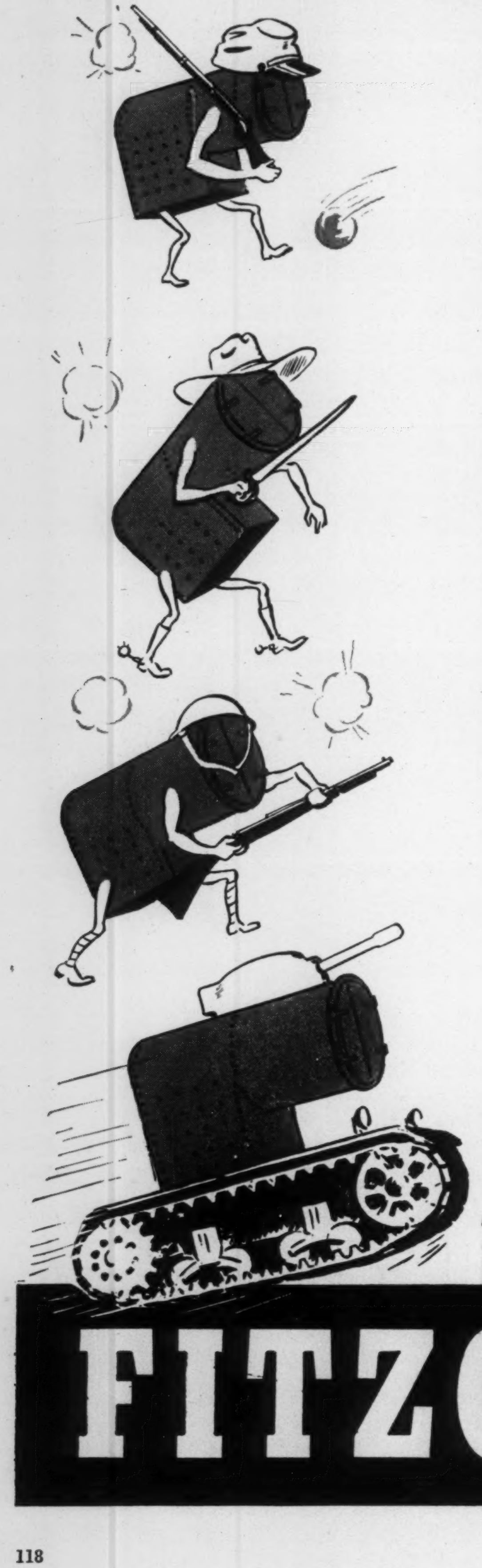
Name.............................. Title..................

Company ....

Address ....

City ....State ....

Is this your first war?



It isn't ours. Nor our second. Nor our third, unless you don't count the Philippine insurrection which was small maybe, but plenty tough. Nor even our fourth, if you include the Indian wars — which you would, if you'd been in them. Ask the shades of Custer's troops.

Anyway, we started making Fitzgibbons Steel Boilers when the Grand Army of the Republic was stepping out right pert and lively, still young. And we haven't stopped making them since, through wars, depressions, pestilence, or what have you.

Survival has become a habit, with Fitzgibbons. Like the race of Man, so designed by nature as to outlast the mastodon. We like to believe that Fitzgibbons Steel Boilers were also correctly designed at their inception, and, backed up by an organization which has long proven its ability to stay young and virile, will still be manufactured long after the present world upheaval has subsided.

Fitzgibbons is in this war a lot deeper than we were in any of the others, making queer things to come out of a boiler works. But we're making steel boilers too — and we intend to be still making them when the veterans of World War II are graybeards.

So far as we may, Fitzgibbons will work to help you maintain Fitzgibbons Steel Boilers and Conditioners now in operation. The cooperation of our Service Department is offered wholeheartedly.

Fitzgibbons Boiler Company, Inc.
101 PARK AVENUE, NEW YORK, N. Y.
WORKS: OSWEGO, N. Y.
BRANCHES AND REPRESENTATIVES IN PRINCIPAL CITIES

★ BUY U. S. WAR BONDS

FITZGIBBONS

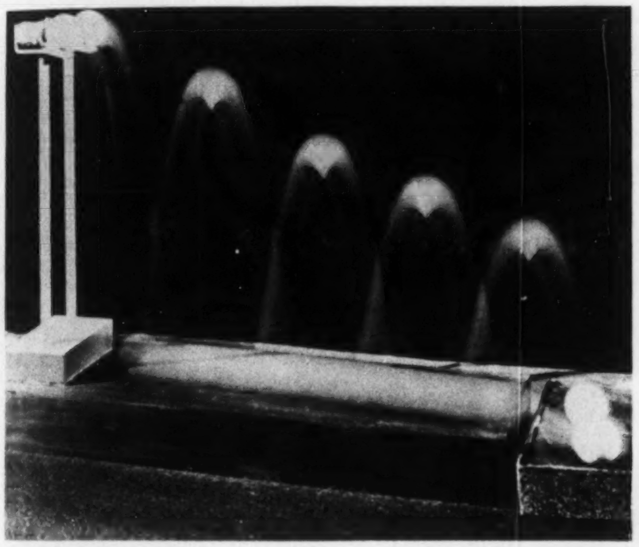
[*Continued from p.* 117]

has been developed; its range of operating temperatures extends from minus 55 C to plus 70 C. It includes apparatus for mechanical refrigerating and electrical heating.

The model illustrated consists of a two stage condensing unit, heat exchanger, liquid subcooler, coil or evaporator, expansion valves, cabinet, and forced draft strip heater, along with thermostats and other controls and connections for each. The entire operation is controlled from a front panel board.—American Coils, Inc., 25-27 Lexington St., Newark, N. J.

"Bounceless" Relay Contacts

No. 2368—Engineers have found that a steel ball half-filled with metallic powder will not bounce, as this time exposure photograph illustrates. Two balls of the same weight—one empty and one containing powder—were dropped simultaneously from the top of the posts, left. The empty ball left a looping trail of light as it bounced four times on the steel plate. The ball containing the powder rolled without bouncing, as shown by the straight streak of light on the plate. Rough surfaces of the metal powder particles created frictional heat, as they slid over each other, dissipating the energy the ball would have used in bouncing, the engineers explained.



This discovery has been used to prevent poor connections by eliminating bouncing and chattering in electrical relays—delicate, swift acting switching devices used in communications systems. The relay contacts are made hollow and partly filled with powder, or special hollow powder containers are attached to the contacts.—Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.

Rotary Air Motors

No. 2369—A rotary air motor which is especially suitable for locations where compressed air is available and where explosionproof equipment is essential, is now available for new applications, according to the manufacturer. It is said to be particularly applicable to war production jobs, such as driving mixing equipment in munitions plants.

These air motors deliver from 1/20 to 1 hp. They are

ENGINEERS CONTRACTORS ARCHITECTS!

The NEW

SAL-MO

Non-Metallic SUPPLY DUCT Will Help Solve Your Metal Shortage Problems

This new non-metallic conduit saves metal in constructing supply and return duct lines of warm air heating, air conditioning and ventilating systems. It permits many installations that would otherwise be impossible because of the shortage in critical metals.

Sal-Mo Supply Duct assures a safe, insulated, fuel-saving duct system. It has been checked by leading independent laboratories and proved to possess a wide margin of safety.

Factory fabricated and packaged in cartons, there is no waste space in shipping and storing. It is most economical and convenient to handle.

S S D in sheets (Sal-Mo Supply Duct) is also available in flat sheets for the fabrication of ducts in your shop or on the job.

NO SHORTAGE—Sal-Mo Supply Duct is available in any quantity and in a complete range of sizes for domestic and industrial requirements.

INVESTIGATE THIS NEW DUCT MATERIAL—SEE YOUR JOBBER AT ONCE OR WRITE US.

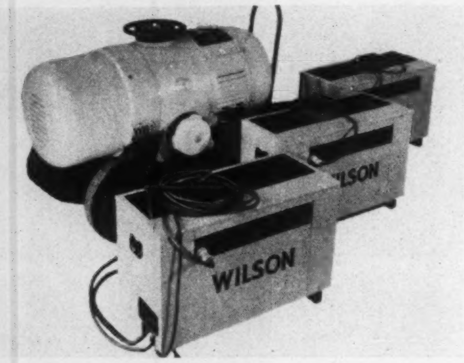
Factory folded and packed in cartons for protection, convenient handling and easy storing.

SALL MOUNTAIN COMPANY
176 W. Adams St. DEPT. F. CHICAGO, ILL.

fitted with ball bearings and all parts are accurately ground. Self-adjusting shaft seals are used in place of packing.—Gast Mfg. Corp., Benton Harbor, Mich.

Arc Welder Control

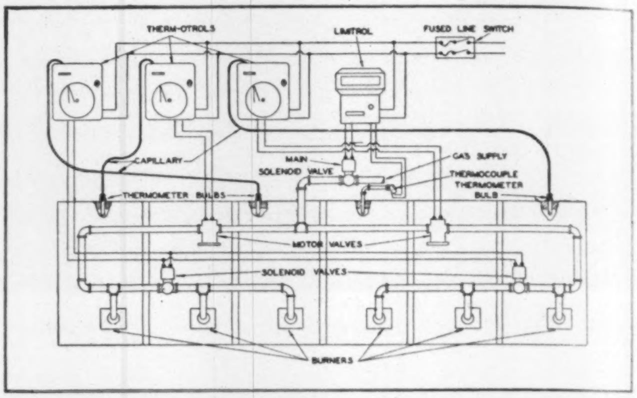
No. 2370—Greater welding output per machine, better control by the operator, and improved welds on thin gage metal are obtainable through the use of the "Honey Bee" arc control station, the manufacturer states.



These arc control stations are made in capacities of 75 and 150 amp. They are an auxiliary electric device, connected in series with the welding circuit of any constant potential arc welding generator. Most conventional drooping voltage generators can be converted quickly and easily to constant potential. For this purpose, a quick change switch is mounted on the generator. A portable switch held in the operator's hand gives the operator remote control of the welding current within predetermined limits. This switch may be combined with the electrode holder, if desired.—Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York, N. Y.

Temperature Control for Dryers

No. 2371—A temperature control application designed to maintain even heat throughout a multiple burner dryer, industrial furnace, oven, or cooker regardless of heat loss at the door or doors, and to give protection against excessive temperature in the event of capillary break or upon failure of control apparatus, is illustrated in the accompanying diagram. It shows the application adapted to a furnace or oven with doors at both ends, while a modification of this burner and instrument arrangement would provide similar control for equipment with one door.



To replace heat lost at the doors and maintain the en-

STOKERS

QUICK DELIVERY!

FOR ALL INDUSTRIAL APPLICATIONS

AMERICAN
COAL BURNER COMPANY
ENGINEERS
CHICAGO, U.S.A.

A Quarter of a Century of Service

tire furnace or oven at even temperature, burners are controlled so that those at the extreme ends burn while those toward the center are out.

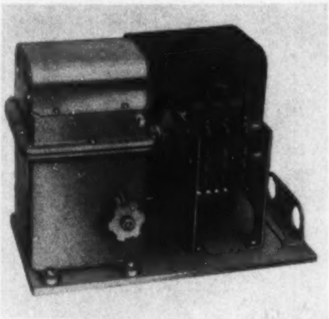
One temperature control instrument, shown schematically at the left, actuates two solenoid valves installed ahead of the center burners in the furnace. It is actuated through a capillary bulb installed at the center of the furnace. Two capillary bulbs at respective ends of the furnace actuate two other temperature control instruments, which, in turn, operate two motor valves. These valves are installed in such a manner that one controls all burners on one end of the furnace, and the other valve all burners at the other end. The arrangement permits operation of the furnace with a higher temperature at one end than at the other.

When starting up the furnace or oven, both motor and solenoid valves are held open as the instruments call for heat. The two instruments controlling the motor valves, actuated from capillary bulbs at the ends of the furnace, are set at the temperatures desired within the chamber, while the remaining temperature control instrument, connected to magnetic valves just ahead of the burners within the furnace, is set slightly lower. When the center of the furnace comes to within a few degrees of the desired temperature, the third instrument closes off fuel to the center burners, leaving the end burners to hold the oven to heat by means of the other two instruments.

When operating the equipment on a tunnel principle with a temperature at the start of the process differing from the temperature at the end, control instruments at the ends of the furnace are set accordingly, while the instrument controlling the center burners is set at an in-between point.

Protection against instrument or control apparatus failure is provided by a "Limitrol," which, when actuated by a thermocouple mounted at the center of the furnace, shuts off fuel supply to all burners by means of a solenoid valve installed in the main gas supply line. This instrument is set a few degrees higher than the maximum temperature indicated by the highest of the temperature control instruments, and shuts down the equipment if this excessive temperature is reached.—Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill.

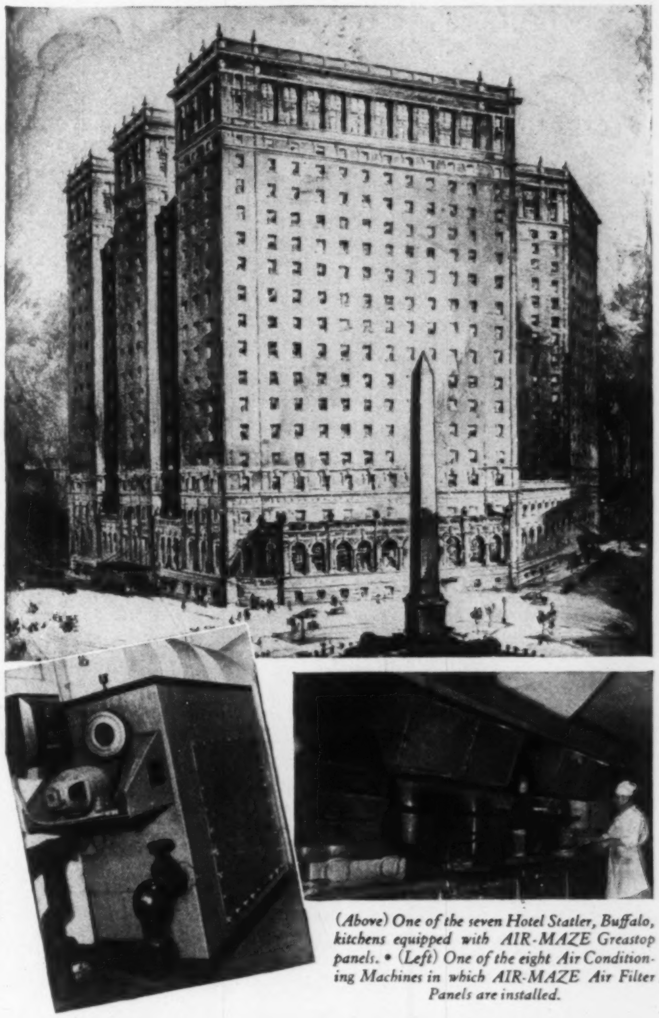
Program Switch



No. 2372—The "Micro" program switch is used to control the operation of compressor motors, pumps, solenoid valves, or motor operated valves on sprinkler systems, pasteurizers, and in industrial process work.

It comprises a series of snap acting, cam operated switches with a "Microtrol" driving unit. Adjustable cams may be rotated to change the operation of the switches and the timing of the driving unit is adjustable.

This device is available with single pole, single throw; or single pole, double throw, switches.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.



(Above) One of the seven Hotel Statler, Buffalo, kitchens equipped with AIR-MAZE Greastop panels. • (Left) One of the eight Air Conditioning Machines in which AIR-MAZE Air Filter Panels are installed.

HOTEL STATLER, Buffalo, is AIR-MAZE Protected

These washable, all-metal air filter panels contribute to comfort, health, and safety of Statler guests and employees

• Famous for its ideals of service, Hotel Statler overlooks no detail contributing to the well-being of its guests and employees.

In Buffalo, Hotel Statler's seven kitchens are equipped with AIR-MAZE Greastop filter panels to collect entrained grease, thus eliminating fire hazards. Besides protecting against fire, these Greastop panels also promote kitchen sanitation, comfort and efficiency.

In this same hotel AIR-MAZE filter panels, installed in its eight air conditioning machines, insure clean, pure air for the comfort and health of grateful guests.

Write us regarding your filtration problems.

AIR-MAZE CORPORATION
5200 Harvard Avenue, Cleveland, Ohio

AIR-MAZE
DEPENDABLE AIR FILTERS FOR EVERY APPLICATION

Remote Control for Welders

No. 2373—A new remote control unit which is now a standard production feature of the maker's welders is protected from accidental breakage by a metal pull out handle set over the control dial and by cushion springs on the back of the porcelain rheostat.

The new dial, it is said, will increase weld qualities—especially welds made under high speed techniques. It places 100 steps of volt-amperage adjustment within reach of the operator's hand. The remote control unit is set up by using an ordinary lamp cord extension to connect it to the machine.

The large outer control dial shown in the picture is the field rheostat which controls the differential compounds, while the remote control unit adjusts the open circuit voltage.—Hobart Brothers Co., Troy, Ohio.

Steam Jacket Pump

No. 2374—A new and simplified steam jacketed pump has recently been put into production. A number of these units have been installed in war production plants for handling such materials as palm oil, lard, tar, greases, and similar liquids that must be processed or transferred while hot.

The steam jacketed heads are made of cast semisteel, with threaded intake and exhaust steam ports, and drain plugs. They are suitable for steam pressures up to 125 psi.

The sleeve bearings are grease lubricated and located outside the pump casing away from the pumpage. Heavy bearing construction eliminates shaft whip and distortion, the maker states. Pumps for pressures in excess of 100 psi are furnished with antifriction bearings.

Standard units in capacities from 20 to 700 gpm and pressures up to 300 psi are available with the new steam jacketed head. They are furnished with either single or double reduction gear drive and as single or multiple pump units.—Blackmer Pump Co., 1809A Century Ave., S.W., Grand Rapids, Mich.

WECO-N. G. E. SERIES F600 GAS BURNERS

If you are installing or converting boilers for Heating and Power—we can handle the combustion part of the job . . . and do it right, with standard or special Webster Burners.

Due to our many years of experience as combustion engineers and the facilities we have for the manufacture of our standard gas and oil burners and control equipment, we can do the same real job during this emergency, as in times of peace.

Our engineering department is thoroughly capable of helping you solve your burner problems and to design special equipment to meet special conditions.

GUARANTEED VIBRATIONLESS

This burner operates on straight natural gas and mixed gas to 800 B.t.u. Gives perfect horizontal distribution. Write for Bulletin No. F600H.

THE WEBSTER ENGINEERING CO.
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION TOLEDO, OHIO

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 117. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Bearing Lubrication

No. 4295—32 p. guide to better bearing lubrication (Form No. 266) covering ball and roller bearings and giving information on the functions of lubrication, oil lubrication, grease lubrication, comparative advantages of oil and grease, high temperature applications, minimum friction applications, protection against moisture, protection of idle machinery, and cleaning. Numerous charts and detailed drawings are included.—SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

Branch Pipe Outlets

No. 4296—16 p. bulletin (WT-31) describing "Weldolets," "Thredolets," and socket end "Weldolets," and telling how to make branch pipe outlets with them. Among the topics covered are how to reduce turbulence and friction, how to make right angle welded branch pipe outlets, and the adaptability of these fittings to piping installation.—Bonney Forge & Tool Works, Tilghman St. and Meadow St., Allentown, Pa.

Brazing

No. 4297—2 p. data sheet on low temperature brazing, illustrating typical war applications of "Easy-Flo" silver brazing alloy.—Handy & Harman, 82 Fulton St., New York, N. Y.

Diesel Engines

No. 4298—46 p. booklet (7609), supplementing operator's instruction books, giving the reasons behind maintenance and operating instructions. Care of certain critical parts is presented in detail.—Caterpillar Tractor Co., 600 W. Washington St., Peoria, Ill.

Electric Air Cleaner

No. 4299—6 p. booklet (B-3083) describing the use of the "Precipitron" electrostatic air cleaner in war industry production. A discussion of the method of operation is supplemented by cutaway views of the power pack and the cells.—Westinghouse Electric & Mfg. Co., Cleveland, Ohio.

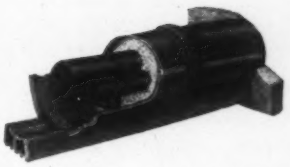
Electric Arc Etcher

No. 4300—8 p. bulletin (1635-A) describing a new electric arc etching process for the permanent identification of parts, tools, etc. The machine deeply etches hardened parts without burr in minimum time and handles either light or deep etching as desired by the turn of a dial, according to the manufacturer.—George Gorton Machine Co., Racine, Wis.

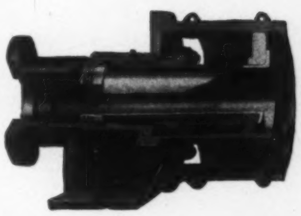
HOW TO KEEP VITAL STEAM LINES AT TOP EFFICIENCY FOR THE DURATION

And for Years Afterward

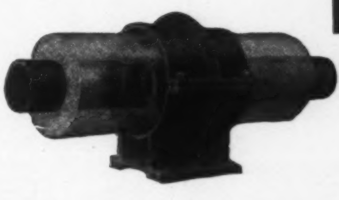
4 VALUABLE ADSCO SUGGESTIONS



1 For underground lines use sectional ADSCO-Bannon Tile Conduit with base drain. Insulated with ADSCO Filler Insulation, a "Fiberglas" product, it provides a permanent installation at low first cost and high thermal efficiency.



2 Determine expansion and contraction of the pipe line carefully, allowing an ample factor of safety. Use ADSCO Piston-Ring Expansion Joints. They can be unpacked and repacked under full operating pressure without interruption to service.



3 Install pipe alignment guides and pipe anchors made by ADSCO. They are essential to avoid undue strain on fittings and expansion joints; good assurance against future line failure.

4 Know your actual steam consumption for heating or process purposes. Install Condensation or Steam Flow Meters. ADSCO can furnish either kind to help you detect steam losses and improve utilization.

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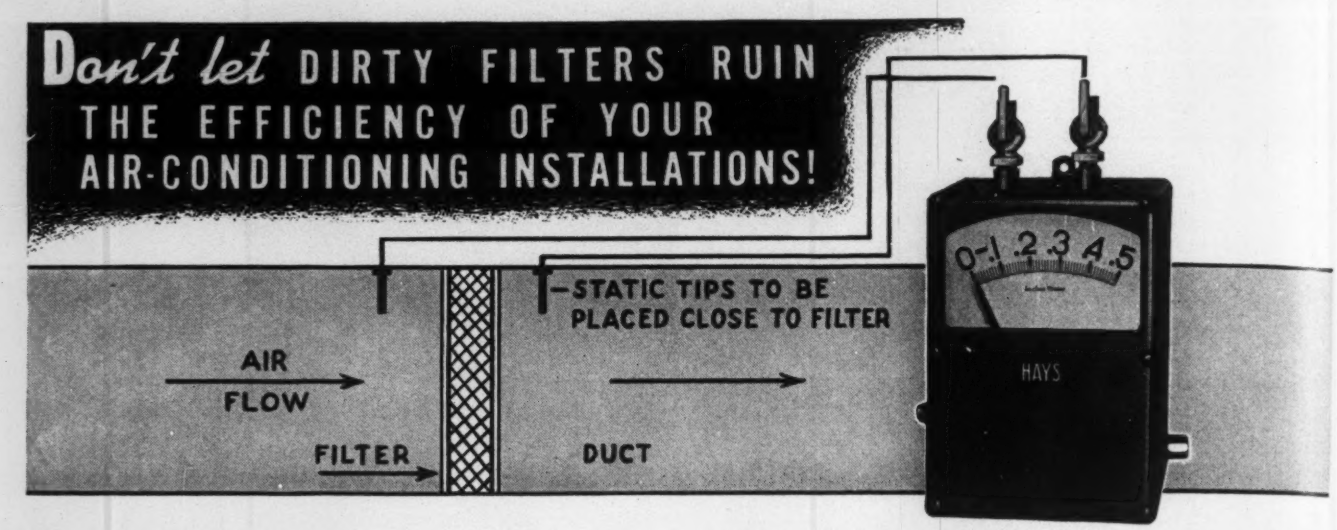
AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA
N. Y.

ADSCO HAS BEEN BUILDING "UP-TO-DATE" STEAM LINE EQUIPMENT *for over 60 years*

Don't let DIRTY FILTERS RUIN THE EFFICIENCY OF YOUR AIR-CONDITIONING INSTALLATIONS!



Dirt clogged filters in any air-circulating system mean reduced efficiency and added power costs. On the other hand, changing filters oftener than necessary is downright waste.

With a HAYS Air-Filter gage installed in a duct you know precisely, at all times, the condition of the filter and Static tips, installed on either side of the filter bank supply a differential air-flow measurement which is indicated on a scale in the remotely mounted gage. If desired, the gage may be made to flash or sound an alarm when filter resistance becomes excessive. And it is also furnished when wanted with electric contacts to operate a damper to control the flow of air through the duct.

The HAYS Air-Filter Gage employs the famous slack-leather diaphragm pressure measuring element and is of the high quality in design, materials and workmanship that has made Hays Gages internationally famous. The price is reasonable. Write us at 990 Eighth Avenue for Publication 40-278.

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COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

EFFICIENT SERVICE—
NO MAINTENANCE EXPENSE IN 10 YEARS.....

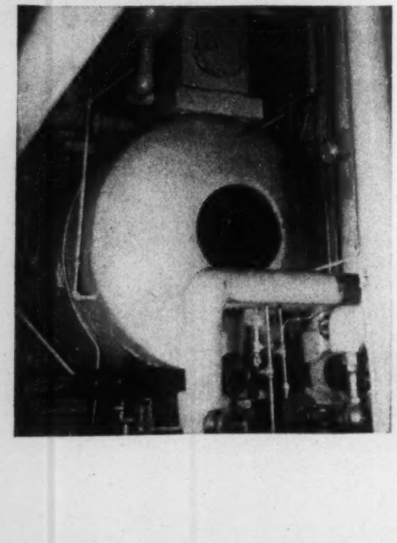
Carey HEAT INSULATIONS in Knickerbocker Laundry

The Knickerbocker Laundry, Long Island City, N. Y., occupies a large, modern building, constructed about ten years ago. Boilers, and approximately 25,000 feet of piping that supply steam to the 150 presses, were insulated with CAREY Products when the building was erected.

The management reports that no labor or money have been spent in maintaining these insulations during their ten years of service.

Such dependable service is not unusual for CAREY Insulations . . . just the run-of-mine performance of these famous products in hundreds of power plants throughout the country.

Carey Insulations combine top efficiency, long service, exceptional impact strength. Which means—maximum fuel saving—minimum upkeep. Profit by these PLUS qualities of CAREY Products when you buy insulations. For details, write Dept. 25.



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Dependable Products Since 1873
IN CANADA THE PHILIP CAREY COMPANY LTD. Office and Factory LENNOXVILLE, P. Q.

Engineer's Calendar

No. 4301—Engineer's calendar, 15¾x24½ in., for 1943 with 52 weekly sheets and numerals designed to be read across the width of a large drafting room. A section of technical data with charts on wire and sheet metal gages, screw threads, etc., is included.—Frederick Post Co., Box 803, Chicago, Ill.

Motors

No. 4302—12 p. bulletin (B6052-C) on "Lo-Maintenance" motors, giving the facts necessary for quickly choosing correct motors for wartime applications in order to utilize fully electric motor power and conserve vital war material. Simplified charts permit the reader to determine the electrical and mechanical characteristics of the motor types designed for the specific applications in which he is interested. Dimension ratings and price lists are included.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Motor Maintenance

No. 4303—Series of seven 4 p. bulletins, each covering installation, care, and adjustment of a different type of motor, and prepared in an effort to help both those who cannot buy motors now and those who are working on high priority jobs. They are written to cover installation and care to help the user and to insure his getting the longest service possible. A system of suggested checks is presented to eliminate first one thing and then another to assist in locating trouble when something goes wrong.—Century Electric Co., 1806 Pine St., St. Louis, Mo.

Motor Manual

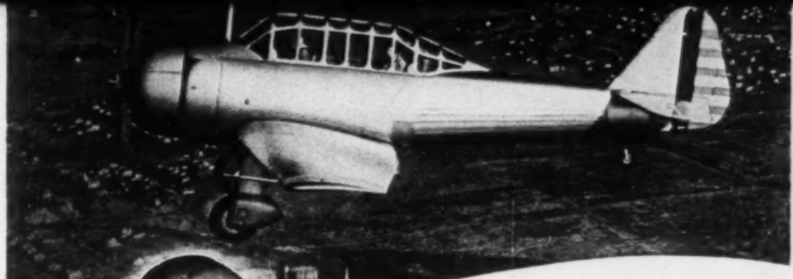
No. 4304—40 p. motor fitness manual (GED-1017) for plants converted to war production, discussing how to get the most service out of old and new motors, switching motors from one job to another, and equipping old machines with new motors. A supplement explains how to save critical motor materials, including WPB recommendations, and gives information on the use of load-time-temperature charts.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Motor Starters

No. 4305—Bulletin describing complete line of "No. 640" semi-automatic resistance starters for manually starting polyphase squirrel cage motors. These starters are recommended by the maker for loads which must be accelerated smoothly or for applications where starting currents must be kept low to prevent lamp flicker.—Allen-Bradley Co., 1335 S. First St., Milwaukee, Wis.

Operation Time Recorders

No. 4306—Bulletin (A-321) presenting information on both electric operated and mechanical operation time recorders, explaining the application of such instruments



HE DREW THE PLANS*
FOR FLEETWINGS' FANS

* Mr. Frank M. Bates, who engineered the Fleetwings' ventilating system. By error in an earlier ad, the designing was credited to the contractor who did a splendid job of installing the Ilg equipment.

FRANK M. BATES, Chief Plant Engineer, encountered an exceptionally severe heat problem in the manufacture of Fleetwings' stainless steel BT-12 basic training planes. Two factors—removal of excessive heat, plus the direct radiant heat of the sun—and revitalizing the air—called for ventilators with motors capable of continuous operation under abnormal heat conditions.

THROUGH THE USE of standard ILG Self-Cooled Motor Propeller Fans mounted in weather-tight penthouses, the problem was solved—rapid air change is quick and positive under all weather conditions. And, due to the ILG exclusive self-cooled motor that "breathes," there is no danger of overheating . . . no effect from moisture condensation . . . costs are lowered all along the line!

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ILG
Vitalized Ventilation
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AIR CHANGE...NOT JUST AIR MOVEMENT!

to the processes of various industries. Their use in test engineering, in setting job standards, and in cost accounting and production control is discussed.—Foxboro Co., 106 Neponset Ave., Foxboro, Mass.

Piping Problems

No. 4307—Circular featuring the scientific approach to piping problems, including the use of "Flex-Anal" charts to facilitate economical design, and functional hangers and vibration eliminators to control behavior of piping systems. A typical piping layout showing applications of the various types of hangers is reproduced.—Power Piping Div., Blaw-Knox Co., 829 Beaver Ave., Pittsburgh, Pa.

Plastics

No. 4308—1 p. folder illustrating various plastic parts for war production.—Creative Plastics Corp., 963 Kent Ave., Brooklyn, N. Y.

Plastics

No. 4309—16 p. booklet on cellulose acetate, describing its properties, types and advantages, telling of some of its uses, and briefly discussing compression molding and injection molding.—Hercules Powder Co., Delaware Trust Bldg., Wilmington, Del.

Plastic Cork Coating

No. 4310—4 p. folder on "NoDrip" plastic cork coating which is offered as a positive preserver of all metal equipment and to stop condensation drip. It may be applied with brush, trowel, or spray. The folder illustrates various applications of this protective coating, gives data on coverage, and shows numerous views of actual applications to piping and other industrial equipment.—J. W. Mortell Co., Kankakee, Ill.

Pumps

No. 4311—8 p. bulletin (B6059-H) which presents a compact compilation of facts on a complete centrifugal pump line. Construction features, sizes, and capacities are listed in a manner which simplifies the choice of proper pumping equipment for specific needs.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Relays

No. 4312—1 p. bulletin (104) on midget metal base relays available for operation on a-c and d-c circuits. Overall height from base to armature is 1¼ in.—Ward Leonard Electric Co., 37 South St., Mt. Vernon, N. Y.

Steam Traps

No. 4313—8 p. service guide and listing of wartime conservation suggestions for steam trap users, covering installation and maintenance, installation of repair parts,

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With pardonable pride

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and trouble shooting, and giving repair parts price lists and dimension tables. Much technical data and numerous practical suggestions are offered.—Armstrong Machine Works, 874 Maple St., Three Rivers, Mich.

Stokers

No. 4314—Circular illustrating and briefly describing the features of the manufacturer's stokers, which include full active grate surface, fully enclosed wind boxes to prevent air leakage, large size motors, heavy duty speed transmission, proportioned air, large cast alloy steel feed screws, etc.—Frederick Iron & Steel Co., E. 7th St., Frederick, Md.

Synthetics

No. 4315—16 p. booklet (1620) containing technical and engineering data on "Tygon," a synthetic rubberlike material. Chemical properties, physical characteristics, specific applications, insulation, and tubing are among the topics covered. Among the uses of this material is the lining of fans and ventilating equipment to protect against corrosive fumes and vapors.—U. S. Stoneware Co., 60 E. 42nd St., New York, N. Y.

Technical Books

No. 4316—64 p. catalog of technical books, including the fields of aviation, engineering, radio, electricity, mechanics, chemistry, and military and naval sciences.—Chemical Publishing Co., 236 King St., Brooklyn, N. Y.

Temperature Control

No. 4317—4 p. issue of "Wheelco" Comments (Vol. 2, No. 2) describing a line of universal controllers for industrial temperature control applications, and covering pyrometers, potentiometers, and thermometers.—Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill.

Temperature Signaling

No. 4318—Leaflet describing "Tempilaq°", an emulsified compound made to melt sharply at a stated temperature, suspended in a quick drying fluid. A thin smear or daub is applied to the working surface and when the specific temperature is reached, the smear liquefies sharply. On cooling, it solidifies, leaving a glossy mark different from the original smear.—Tempil Corp., 132 W. 22nd St., New York, N. Y.

Thermocouples

No. 4319—6 p. bulletin interpreting the recently amended WPB conservation order L-134, as it applies to the use of thermocouples and thermocouple protecting tubes for pyrometric instruments. Known as the supplement to thermocouple data book S2-3, it recommends thermocouples and tubes that will serve in place of materials prohibited by the WPB order.—Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill.

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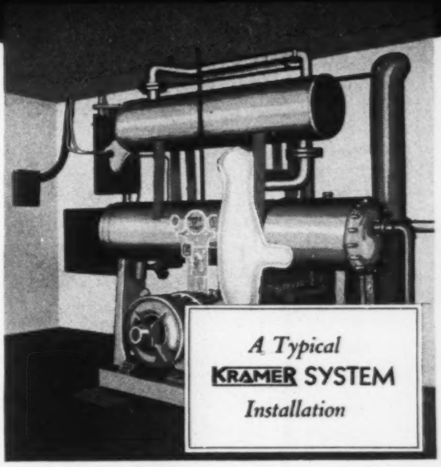
Balance Loader
SYSTEM

The Greatest Achievement
IN REFRIGERATION CONTROL
SINCE THE INTRODUCTION OF
THE THERMOSTATIC
EXPANSION VALVE



The KRAMER Balance Loader SYSTEM (Patented) is a modulating refrigeration system capable of varying from 0% to 100% of full load, and maintaining a fixed minimum back pressure in the suction line and in the compressor crank case.

The KRAMER SYSTEM will automatically compensate for varying evaporator loads, resulting in an infinite number of compressor capacity points, giving straight line capacity modulation.

The KRAMER SYSTEM is the only one that will give a full range of modulation at a fixed minimum back pressure throughout the entire low side.

The KRAMER SYSTEM can be applied to new or existing refrigeration installations

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KRAMER TRENTON Co.
MANUFACTURERS OF
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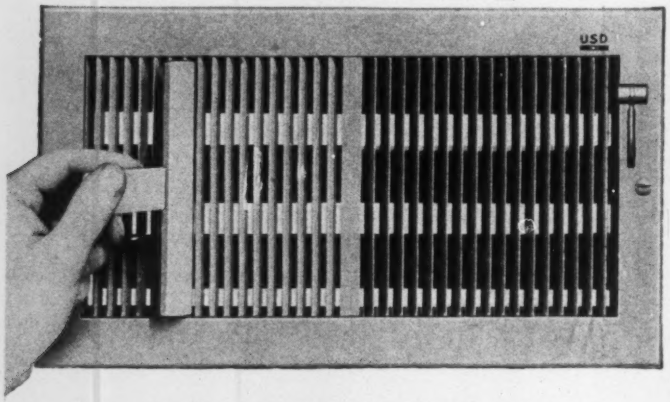
AUER REGISTERS *for* Low-Cost Homes *and* WAR-TIME CONSTRUCTION

Auer has numerous types of registers, simple in design but substantial and efficient, which meet the requirements of the small home market, and are also appropriate for larger buildings for the use of our armed forces.

On many such projects, the buildings are being equipped with such modern registers as the Airo-Flex No. 4432 shown below. This register has multiple louvre back-blade with indicator on face to show position of blades. Grille bars are adjustable too, with turning tool, for any desired lateral flow. This Airo-Flex gives 4-way air control, is very pleasing in appearance and yet it is not expensive.

Other well-known Auer models, such as Classic, Heat-Rite, and DuraBuilt, are also well adapted to wartime purposes.

Write for Complete Auer Register Book showing all types of registers and intakes for warm air and air conditioning—or for Catalog "G" on flat metal grilles.



No. 4432 Airo-Flex Adjustable Register

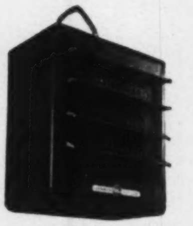
THE AUER REGISTER COMPANY
3608 Payne Avenue Cleveland, O.

AUER REGISTERS
& GRILLES
For Air Conditioning *and* Gravity

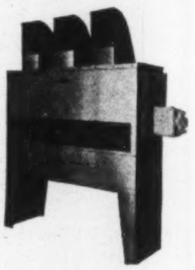
FOR ARMY-NAVY PROJECTS and WAR INDUSTRIES

At this time The Herman Nelson Corporation is busy furnishing Heating, Ventilating and Air Conditioning Equipment for use everywhere in connection with work vital to our National War Effort. However, The Herman Nelson Corporation is maintaining Sales and Service Offices in all Principal Cities in order to help facilitate war work. Each office is equipped to quote and aid in working out details for your war project.

Herman Nelson hijet Heaters



Horizontal Shaft Propeller-Fan Type hijet Heater projects warm air downward in the desired direction. Eliminates waste fuel and space. Available in 48 models, sizes and arrangements.



Herman Nelson Blower-Fan Type hijet Heater provides efficient heating of large areas. Streamline discharge outlets maintain large air delivery with high velocity. For floor, wall, ceiling, or inverted wall mounting. Available in 150 models, sizes and arrangements with a wide range of capacities.

Autovent Fans and Blowers

Autovent Propeller Fan. Exclusive Autovent design—direct or belt driven. Ruggedly constructed for economical operation under severe conditions. Available in wheel diameters from 9 to 72 inches; capacities 450 to 45,000 cfm.

Autovent Blower for heavy duty ventilating and air conditioning installations. This Blower can be furnished to any speed or discharge requirements, in a wide range of sizes.

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THE HERMAN NELSON CORPORATION
MOLINE, ILLINOIS
Manufacturers of Quality Heating, Ventilating and Air Conditioning Products

Thermocouple Pyrometers

No. 4320—58 p. catalog (N-33A) on "Micromax" thermocouple pyrometers, designed to give wartime users first hand the information they want about indicators, recorders, and controllers, and the accessories which are used with them.—Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.

Valves and Fittings

No. 4321—4 p. bulletin (192-A), giving allowable working pressure for refrigeration valves and fittings for ammonia or "Freon-12" service.—Frick Co., Waynesboro, Pa.

V Belt Drives

No. 4322—12 p. bulletin (B6051-C) designed to simplify the problem of selecting correct v belt drives for wartime applications. A great deal of engineering information is presented in simplified chart and table form for quick selection. List prices, stock sizes, dimensions, and construction details are included for all "Texrope" drives. —Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Wartime Production

No. 4323—Issue of Sparks (Vol. 1, No. 2) describing how the manufacturer boosts war production morale by means of a plant war production drive committee and various stunts and posters.—Tube-Turns, 238 E. Broadway, Louisville, Ky.

Welding

No. 4324—2 p. mimeographed bulletin (165) on "Castolin" eutectic low temperature welding as a substitute for scarce bronze or brass welding rods. A comparison of the procedures for bronze welding and for this method of welding is presented.—Eutectic Welding Alloys, 40 Worth St., New York, N. Y.

Welding Accessories

No. 4325—Leaflet describing the "Safti-Kupler," which according to the manufacturer guarantees complete safety to the operator of any a-c welding machine. —A-C-Devices Co., 2608 N. Cicero, Chicago, Ill.

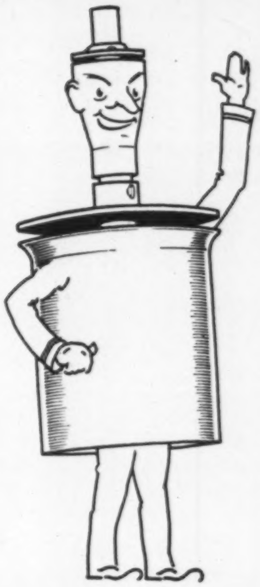
Welding Accessories

No. 4326—32 p. bulletin (GEA-2704B) on arc welding accessories giving information on a complete line which includes goggles, observation shields, ventilated head protectors, protective clothing, welding screens, protective paint, electrode holders, clamps, cable connectors, brushes, chippers, electrode carriers, and fillet weld gages.—General Electric Co., 1 River Rd., Schenectady, N. Y.

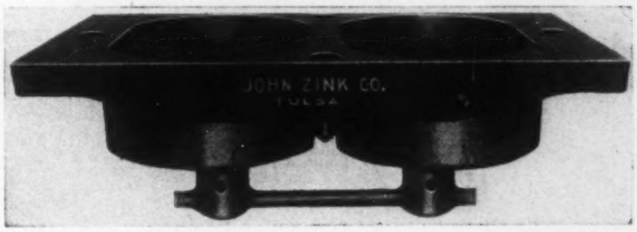
Welding Positioner

No. 4327—2 p. data sheet announcing a new welding positioner designed to handle loads up to 22½ tons with

"It's a
Miracle Burner"



The John Zink
VERTICAL BI-MIX



- Burns with a short flame natural, refinery or propane gases at low or high pressures; in fact the fuel is often switched from natural to residue to propane without adjustment.
- So installed that all air entering the fire-box passes through the radiating armed spiders, making an efficient steam generator.
- So strong and sturdy, workmen may walk on it when inspecting or repairing the boiler.
- Short flames insure proper heat placement without loss of tubes.

Write for Details Now!

John Zink Co.
TULSA, OKLAHOMA
New York — Los Angeles — Atlanta

FOR LOW-COST HEATING, QUICK INSTALLATION AND METAL CONSERVATION

DIRECTHERM UNIT HEATERS STOKER-FIRED

It is a self-contained unit and can be installed or moved in a few hours. No duct work, radiators, or pipes are necessary.

To tend a Directherm requires a minimum of attention. Once the automatic controls are set, they need not be changed. An unskilled man can take care of it . . . important in these days of labor shortage.

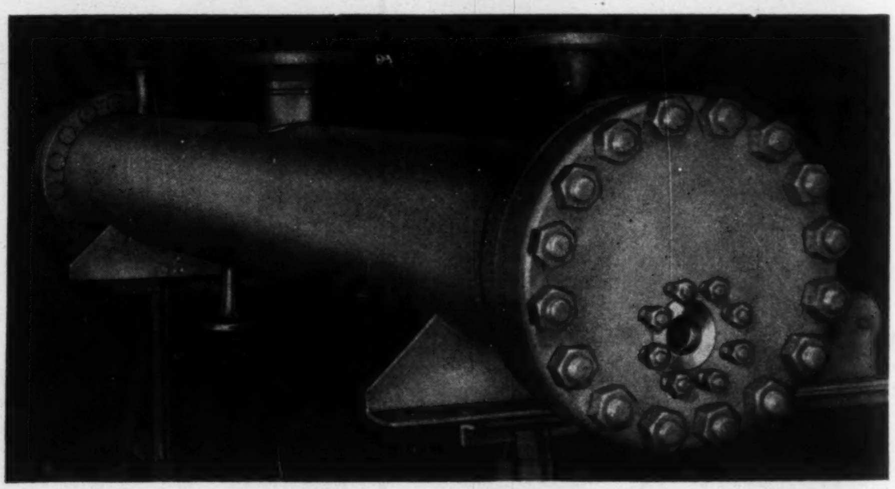
Made in 6 sizes (300,000-1,700,000 BTU).

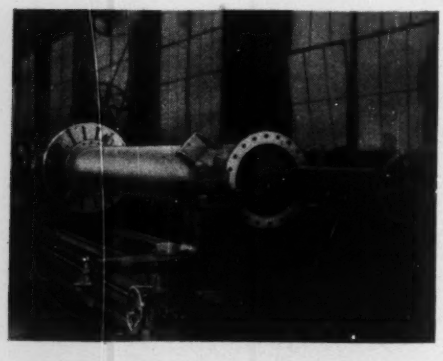
AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. · ST. LOUIS, MO.

Specialists

IN FABRICATION FOR *Heat Transfer Work!*

Downingtown has a well-rounded background in the construction of heat transfer equipment. You'll find we "speak your language", and can help you get a good fabrication job.





Our shops are "tooled" for efficient production of this equipment, and all precautions are taken to insure quality. Downingtown-built heat transfer equipment has extra capacity to meet peaks that may exceed normal duty. Design and details of construction are worked-out to meet each user's exact needs.

Illustration at right, above, shows a Downingtown engineered and built Cooler for a complex mixture of gases at high pressure and low temperature, using direct expansion of the refrigerant in the shell.

At left, ends of 20 inch by 15 foot heat exchanger shell are being faced in Downington shops.

SEND FOR YOUR COPY of our 4-page folder which describes the type and range of heat exchanger work best handled by Downingtown. A note on your letterhead brings it; ask for Folder 4-B.

DOWNINGTOWN IRON WORKS
DOWNINGTOWN, PA.
HEAT EXCHANGERS

a center of gravity 12 in. from the table top.—Ransome Machinery Co., Dunellen, N. J.

Zone Temperature Control

No. 4328—2 p. bulletin giving information on the features of compensated control for zone temperature control work. Heat anticipation is provided only when needed and in the amount required by a particular weather condition, according to the manufacturer, and overheating is eliminated by maintaining low radiator temperatures in mild weather and higher radiator temperatures as the need for heat increases. The method is suitable for use in new and existing buildings and may be adapted to a wide variety of heating systems.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Useful Information

List of American Standards

The American Standards Association announced last month the publication of its newest list of American standards for 1942.

More than 550 American standards are listed, of which 71 represent new and revised standards approved since the last (February, 1942) issue of the list. These are marked with an asterisk.

There is a separate heading for American war standards—standards developed specifically for the war effort.

Another section is devoted to American safety standards, which are also of great importance to the war effort in connection with the President's program for the conservation of manpower.

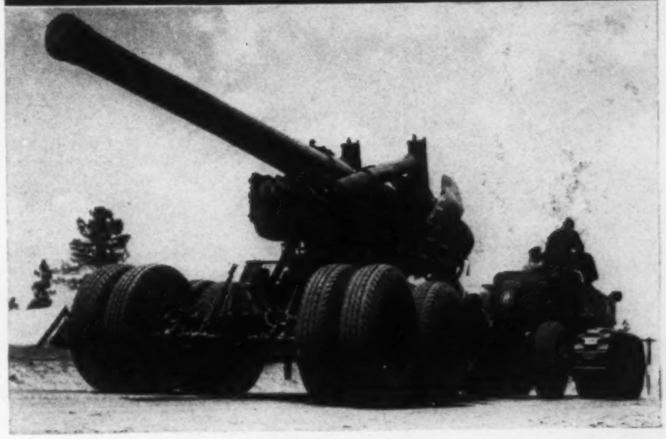
Other standards include definitions of technical terms, specifications for metals and other materials, methods of test for the finished product, dimensions, etc. They reach into every important engineering field and serve as a basis for many municipal, state and federal regulations. This particular list of standards will serve as a useful reference piece to the engineering and purchasing departments of many manufacturing firms.

Standards have assumed a vital role today in connection with the war effort. Government orders are based on specifications and standards are further used in industry in simplifying the production problem, conserving materials, pegging quality to price control, in inspection, and in contracting and subcontracting. A large part of ASA's work is now on wartime jobs requested by Army, Navy, WPB, OPA, and industry. In fact, the ASA is under contract with the federal government to carry on an increasing amount of such work.

In each case, the standards approved by the ASA represent general agreement on the part of maker, seller, and user groups as to the best current industrial practice. More than 600 organizations are taking part in this work.

This list of American standards for 1942 will be sent free of charge to anyone writing in for it. Requests should be addressed to the American Standards Association, 29 W. 39th St., New York, N. Y.

Victory Metal



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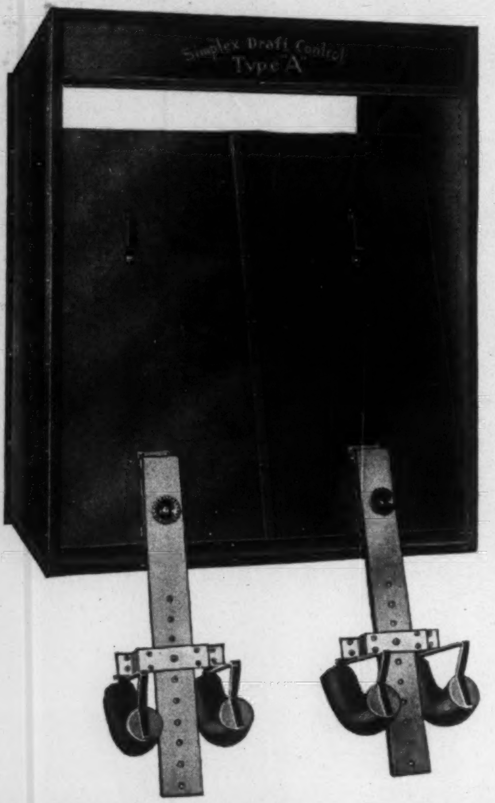
. . . . . AT A THOUSAND POINTS OF ATTACK!

On the battle fronts . . . on the essential home fronts . . . at a thousand points of application where corrosion can disable and destroy . . . Copper is standing guard. Speed, too, an essential factor in Victory, is being equally well served on America's production lines by the uniformity and easy workability of Hussey Copper.

HUSSEY

Reading down:
(1) and (4)—Photos by U. S. Army Signal Corps.
(2)—Official U.S. Navy Photo
(3)—Official Photo, U.S. Army Air Forces.

C. G. HUSSEY AND COMPANY
(Division of Copper Range Co.)
Rolling Mills and General Offices: PITTSBURGH, PA.
Warehouses in Principal Cities



Save Fuel!

INSTALL SIMPLEX AUTOMATIC DRAFT CONTROL

The present emergency makes it of vital importance that extravagant operation of boiler plants be stopped in order to conserve fuel so necessary to the National Defense Program. The surest and quickest way to positive fuel economy is the installation of Simplex Automatic Draft Controls which deliver secondary air automatically to the stack breeching, thereby reducing, to the desired point, the draft pull on the boiler, naturally resulting in more perfect combustion.

Simplex Automatic Draft Controls also reduce the flow of hot gases through the boiler, reduce infiltration of air in the boiler setting, reduce the amount of "cold air inrush" which causes sudden shrinkage of all boiler parts and settings when the fire doors are opened. It eliminates hot spots in the coal bed, causing local hot spots in the boiler, and in oil and gas fires, it eliminates floating or pulsating flames and the "sucking out" of pilot lights, causes good ventilation in boiler room by diluting the stack gases with boiler room air. It will also improve feed-water regulation, allow even more superheat, reduce clinker trouble, lengthen the life of tubes and grates and reduce tube clogging due to high blast pressures through thin fires.

The adjustment of the Simplex Automatic Draft Control is worked out scientifically, but simply, and can be regulated to a point of very accurate performance.

These superior draft controls are the answer to the heat waste question in boiler rooms and it will pay you well to learn more about them. Further information on request, please write for it. Made for any size Industrial, Commercial or Domestic boiler plant.

SIMPLEX MANUFACTURING CO.
198-206 No. Main St., Fond du Lac, Wis.

There's a BINKS cooling tower for every air-conditioning job

Induced Draft Cooling

Natural Draft Cooling

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Indoor Installations

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BINKS cooling towers are designed to cut down water bills and reduce operating costs of modern air conditioning equipment. Each tower is tailor made for the particular job in hand. The towers are light in weight, adaptable to small areas and quiet in operation. BINKS ROTOJET spray nozzles break the water into an exceptionally fine mist for maximum cooling. Drift moisture is reduced to a negligible factor. In BINKS cooling towers both the first cost and operating costs are low. BINKS cooling towers are made in all sizes and types—forced draft or natural draft—for use indoors or outdoors.

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Damage to Piping Through Enemy Action

Proneness to damage of industrial plants through enemy action was discussed in a paper by Hal Gutteridge, consulting engineer, presented before the Institution of Mechanical Engineers, London, and reproduced in Engineering, the journal of the Engineering Institute of Canada, for October, 1942.

The variable proneness to damage is conveniently denoted by a number which indicates the percentage of the value of the item (in its condition just before the incident) which has been lost by the damage it has suffered. This might be called the "damage proneness number," or "d.p.n."

In speaking of factory piping services, the author said that the general practice of attaching service piping to the most convenient point of support has persisted despite the many advantages in accessibility, clean layout, absence of obstruction, and protection from fire or other damage which is realized by placing such piping below the ground floor level in covered channels, with vertical branches only to the points to be supplied. An added reason for such treatment is provided by the threat of air raids, for piping not so arranged is particularly vulnerable to blast, fire, or falling debris. It cannot be too strongly impressed that the supply services carried by such piping are the arteries supplying lifeblood to the machines without which they cannot operate. Factory piping should therefore receive the attention which its importance warrants, and improvements should be sought in the following directions:

1) The total length of the service lines should be as short as possible.

2) The piping should be duplicated within reasonable limits, the second line being far enough away from the first to avoid the possibility of one bomb destroying both.

3) Adequate protection should be given by placing the piping underground, or disposing it in other ways.

If piping is attached to the structural members and total collapse of the building takes place, the piping will become a total loss with a damage proneness number approaching 100, for none of it, except the valves, is worth recovering. If, however, the piping has been placed underground, then even with a total collapse of the building, only the vertical runs—and these are the less important—will be lost; and the damage proneness number may be expected to lie between 40 and 80, according to Mr. Gutteridge.

Concentration of Manganese

The American Standards Association, 29 W. 39th St., New York, N. Y., has issued a war standard on the Allowable Concentration of Manganese, Z37.6-1942. It covers the properties of manganese, permissible concentration, and sampling procedure and analytical methods. There is also a short bibliography.

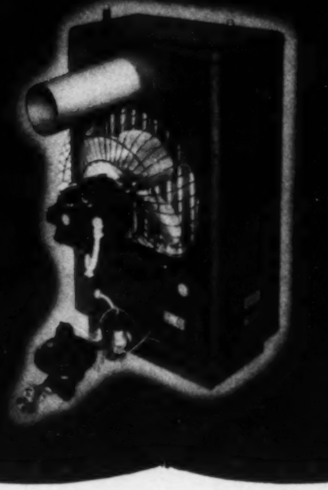
Price of this standard, which may be ordered from the American Standards Association at the above address, is 20c.

Testing Hot Water Unit Heaters

The first edition, first printing, of the Standard Code for Testing Hot Water Unit Heaters, published by the Industrial Unit Heater Association, 5-208 General Motors Bldg., Detroit, Mich., is now available for distribution to the public gratis.

By establishing a standard method of test, the public

REZNOR
Gas Unit Heaters



Now Available For War Production Factories

● Restrictions on the manufacturing of Reznor Gas Unit Heaters have been removed by W. P. B. This action will not make heaters available to anyone other than armed forces and industries with high priority ratings. Thus, war factories may be provided with a system which saves 89% in vital materials. Reznor equipment also requires less installation time, and it economically moves more warm air over wider areas. Write today.

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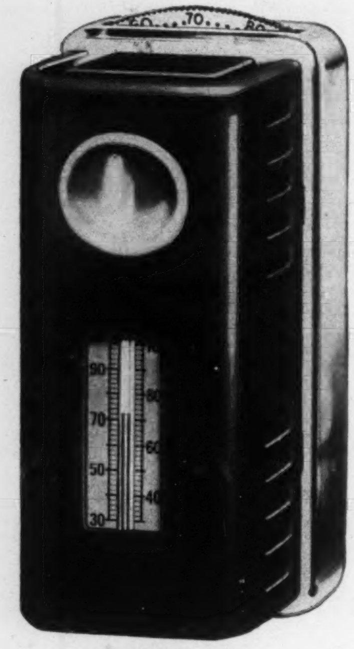
For Industrial Applications . . .



Series 150

WHITE-RODGERS SERIES 150 heavy-duty line-voltage Thermostats will handle many multiple unit heater installations without the need of a relay.

Especially recommended for industrial applications demanding accurate control plus continuous heavy-duty performance.

Available with locked dial and "ON," "AUTOMATIC" and "OFF" dial positions which serve as a manual switch for summer fan operation or to turn off the system during temporary shutdowns. (Meet U. S. Army Specifications.)

WHITE-RODGERS ELECTRIC CO.

1205k Cass Avenue, St. Louis, Mo.

is assured of uniform practices throughout the industry. As a further identification to the buyer that unit heaters offered have certified ratings, member companies attach or print in catalogs, the IUHA label shown on the back cover of this 12 p. publication.

Coal and Coke Standards

The American Society for Testing Materials has issued its 1942 edition of the compilation covering all of the 27 methods, specifications, and definitions of terms developed through its committee D-5, in which leading consumers and producers are active. A number of changes appear in the latest edition as compared with the previous 1940 number, including modifications in standard methods of laboratory sampling and analysis of coal and coke (D271-42).

The compilation includes specifications for classification of coals by rank and by grade, requirements for gas and coking coals, and specifications for sieves for testing purposes. The methods which are coming into widespread use cover coal sampling procedure and methods of test for grindability (ball mill and Hardgrove machine methods), sieve analysis, agglutinating value, drop shatter test, an index of dustiness of coal and coke, and other corresponding tests for coke with additional tests for volume of cell space.

Copies of this 130 p. publication may be obtained from ASTM headquarters, 260 S. Broad St., Philadelphia, Pa., for $1.35.

Air Conditioning Installation Statistics

The Edison Electric Institute, 420 Lexington Ave., New York, N. Y., recently issued its 1941 statistical report of 150 electric utility companies on air conditioning installations. The fourth annual report on the subject compiled by the commercial department of the EEI, it gives data on air conditioning installed by residential, commercial, and industrial customers in the territory served by 150 operating utilities during 1940 and 1941, and the total of all installations as of December 31 last year. The utilities reporting serve over 20,000,000 customers.

Industrial installations were 6 per cent in number and 9.1 per cent in horsepower in 1940, while in 1941 they represented 7.3 per cent in number and 20 per cent of the connected horsepower.

Copies of this report may be had from the EEI at 50c each.

Compressed Air in Industry Contest

The Compressed Air Institute, 90 West St., New York, N. Y., recently sponsored a contest on compressed air in industry. There was a first prize of $200, three second prizes of $100 each, and ten third prizes of $50 each.

A paper by Vincent L. Greth, engineer, Westinghouse Electric & Mfg. Co., entitled Bernoulli Theory Put to Practical Application, received one of the third prizes. This paper described the application of the Bernoulli principle in freeing dies from die stamping machines and speeding up the manufacture of parts for electrostatic air cleaners. His method promises to increase the speed of other die stamping operations.

A paper by George C. Tucker, maintenance engineer in a granite factory, also received a third prize. He

Equipped for Food Service and Air Conditioned Throughout with

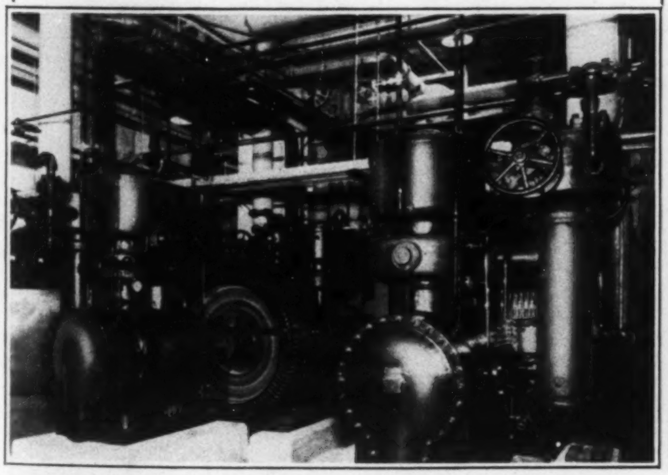
FRICK Refrigeration

The magnificent new Robert Driscoll Hotel and Office Building, at Corpus Christi, Texas, uses a total of eleven Frick machines for cold storage, holding frozen foods, cooling drinking water, and air conditioning the entire 20-story structure—one of the very few now in use, so well equipped.

Where the greatest dependability is required, there is only one choice—Frick Refrigeration. Full information will be supplied by your nearest Frick Branch or Distributor. Or write

FRICK Co.
WAYNESBORO, PENNA. U.S.A.
DEPENDABLE REFRIGERATION SINCE 1882

Below: Three of the Five Big Frick Freon-12 Compressors at the Robert Driscoll



CAPACITIES
Coal Rating 5000 to 17,000 sq. ft. for steam and 8000 to 27,200 sq. ft. for water.

Hank

sez:

There's Big Business TO BE HAD WITH These Big Fifties

OUR Burnham Big Fifty inch cast iron boilers have sure been goin' ter town.
Reports has been comin' in, of what a whale of a job they are doin'. Comin' in even from fellers who use ter say they "wouldn't have a big cast iron boiler fur a gift".

But like so many things some folks don't know any too much about, they think they know it all. But there's sure a lot of such folks that's lately been gettin' wise to themselves on this boiler.

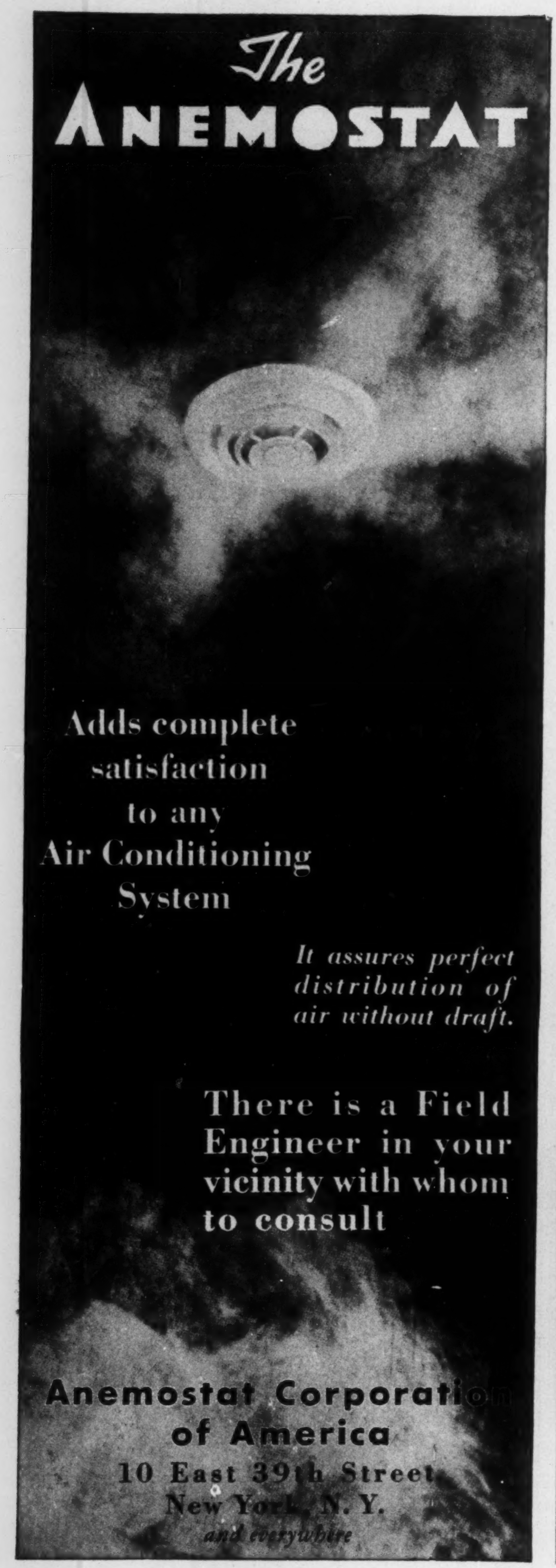
Fur a spell there, we wuz way behind on shipments, there wuz so many wantin' 'em.

Although we ain't quite caught up yet, it might be a smart thing to be gettin' some of these Big Fifty sales, while gettin' is so durn good.

HANK

Burnham Boiler Corporation
Member of the Institute of Boiler & Radiator Mfrs.
Irvington, N.Y., Dept. P. Zanesville, Ohio, Dept. P.
Branch Offices In All Principal Cities
Export Dept.: 50 Church St., New York City

Burnham Boiler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ANEMOSTAT

Adds complete
satisfaction
to any
Air Conditioning
System

It assures perfect distribution of air without draft.

There is a Field Engineer in your vicinity with whom to consult

Anemostat Corporation of America
10 East 39th Street
New York, N. Y.
and everywhere

discussed the storage ratio and how to get more value out of compressed air, describing a system of storing compressed air which makes its production more economical.

Stephen M. Dunham, sales engineer for Worthington Pump & Machinery Corp., received a third prize for his paper describing how compressed air machines were installed on the 10th floor of a loft building for a cosmetic manufacturer who uses the air to pulverize face powder. Machines were installed in such a way as to eliminate vibration in the building and to keep the powder free of foreign material.

A paper by Major G. K. Saurwein also received a third prize. He discussed compressed air service for institutions, describing the system at Harvard University which is used for a multitude of purposes at the various buildings.

Standard for Refrigeration Condensing Units

A recommended commercial standard for commercial electric refrigeration condensing units is being circulated by the National Bureau of Standards, Washington, D. C., to the industry for written acceptance. The purpose of this standard is to establish minimum specifications and methods of tests for the guidance of manufacturers, distributors, installers, contractors and users. It was adopted by a manufacturers' conference June 23 and revised in accordance with subsequent comment. It covers air cooled and water cooled units in 1/5 to 3 hp sizes, and water cooled units of 5 hp using methyl chloride, "Freon-12," or sulphur dioxide refrigerants.

The leak test specified in a previous draft of the

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INDICATING
and
RECORDING THERMOMETERS

Some of the many different types of Dial Indicating and Recording Thermometers we make are shown here. We also make Recording Regulators and Regulators combined with easy to read Indicating Thermometers. **Write for Bulletins.** Specify type of instrument in which you are interested.

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50 Years of Temperature and ★ Humidity Control ★

standard has been revised to read as follows: "Test all joints for leaks. Use a good halide torch leak detector for "Freon," a soap solution for methyl chloride, and a strong ammonia swab for sulphur dioxide."

Proposed Standard for Mineral Wool

A proposed commercial standard for mineral wool, as submitted by the Industrial Mineral Wool Institute and revised at a manufacturers' meeting on September 18, is being circulated to manufacturers and to a number of distributing, constructing, architectural, and user organizations for comment.

The purpose of the standard is to establish minimum specifications for insulating low temperature areas with mineral wool for the guidance of manufacturers, distributors, installers, contractors, and users; to avoid delays and misunderstandings; and to provide a basis for guaranteeing compliance through certification.

Treatment of Coal With Calcium Chloride

An extensive program of research on the treatment of coal with calcium chloride to reduce dust in handling and to avoid difficulty with the freezing of wet coal has been initiated at Battelle Memorial Institute under the joint sponsorship of the Calcium Chloride Association and Bituminous Coal Research, Inc., according to an announcement by Clyde E. Williams, Battelle director.

Calcium chloride long has been used for the treatment of coal at the mines and at the dealers' yards. Because of its moisture attracting and moisture holding properties, it keeps enough moisture on the coal to make the fine particles stick to the larger pieces, and thus avoids

STOP THAT DRIP

APPLY WITH BRUSH, TROWEL OR SPRAY

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

A SURE CURE

NoDrip ● This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition. Permanently protects metal against rust and corrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.

Stucco-like finish requires no maintenance and can be painted any color. A gallon covers about 30 feet of 1" O.D. pipe. Comes in 1, 5 and 55 gallon drums.

Immediate Shipment. Order from your Supply House. Write for **NoDrip Handbook.**

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In preparing this catalog, we have endeavored to supply valve users with a clear, concise and easy-to-read reference book. The descriptions and illustrations are complete. Enlarged sectional views show all construction details. Valves for special services are grouped in separate sections. Also included are list prices and illustrations of valve parts, as well as many tables of useful information relating to valves and piping.

The service and construction details, grouping, indexing, etc., have been arranged so as to be of the utmost convenience to users.

To get your copy of this new FAIRBANKS CATALOG No. 42 without cost or obligation, write or simply mail the coupon.

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Standard and Renewable **Valves**

Used Dart Unions
ARE NOT SCRAP
... they can be used again and again

OFFICIAL SALVAGE DEPOT

Get in your scrap . . . *every bit.* BUT be careful not to turn in used DART UNIONS . . . because even though Darts have seen extensive service, they are capable of going back on the job with tight-joint performance.

Sounds almost too good to be true? Not when you realize that Darts have always been *made* to be used time and again . . . and to resist rough handling. Darts have matched bronze seats, ground to "true-ball" surfaces . . . and Dart bodies and nuts are made of air-refined malleable iron just so that Dart Unions *can* give you this extra service.

Try *your* used Darts . . . and if you need new ones, see your supplier today.

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UNIONS
E. M. DART MFG. CO., PROVIDENCE, R. I.
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G&O RADIATION

FOR HEATING AND COOLING IN A WIDE RANGE OF SIZES

Send for Catalog

Detail of mechanical joint used in Universal Heat Transfer Coils.

THE G&O MANUFACTURING COMPANY
New Haven, Connecticut
Pioneer Manufacturers of Square Finned Tubing in the United States

a dust nuisance when the coal is delivered or shoveled. Solutions of calcium chloride freeze at much lower temperatures than does water. The application of the salt to coal that is loaded into cars wet after a wet cleaning process will avoid the freezing of the coal into a solid mass in the car in severe winter weather.

Despite the extended experience with the use of calcium chloride, Mr. Williams pointed out that information is lacking on the correct amounts to be used for most effective treatment of coals of various ranks and sizes and on the best methods of application to the coal. The program of research is to be directed toward obtaining complete and authoritative information on these points. By cooperation with the coal industry, through its research agency, Bituminous Coal Research, Inc., the information will be quickly disseminated to the coal producers and will be quickly translated into practice.

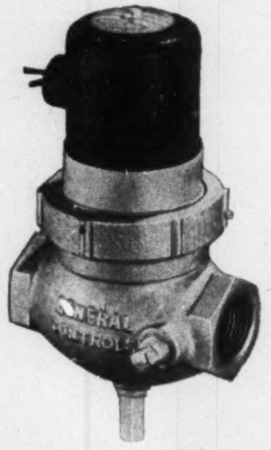
Factors Influencing Radiator Output

Dr. David Dropkin, instructor in experimental engineering and Westinghouse research associate at Cornell University, is the author of a new bulletin, No. 29, Some Factors Influencing the Heat Output of Radiators, of the Cornell Engineering Experiment Station, Ithaca, N. Y.

The problem of proper radiator rating is of interest to both user and manufacturer. The first is concerned with securing a source of heat which will meet the calculated heat losses under the worst conditions which may be expected for any appreciable duration of time. From the standpoint of the manufacturers all ratings should be on the same basis in order to enable the progressive company to improve its product.

ACKNOWLEDGED LEADER IN ITS FIELD

K-3B



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Universally Accepted as Standard Means of Providing Positive Control of Gas To Heat-Treating Ovens, Boilers, Furnaces—other industrial applications.

★ Available in widest range of sizes, from 3/8" to 6" I.P.S.

★ For operating pressures up to 5 pounds.

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★ For all voltages and frequencies, A.C. or D.C.

★ Quiet, positive and trouble-free operation.

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Cleveland • Detroit • Chicago • Dallas • San Francisco

Non-Deaerating Heaters

The Heat Exchange Institute, 90 West St., New York, N. Y., has announced the publication of a new standard to complement its series on surface and barometric condensers, and steam jet ejectors.

The new publication is entitled Standards of the Non-Deaerating Heater Section and contains recommendations on nomenclature, definitions, construction, ratings, accessories, and a typical specification. This specification feature has been planned to assist the designing engineer in furnishing the information necessary for construction of the proper unit.

Price of this publication is 75c per copy.

Intermittently Heated Buildings

The Texas Engineering Experiment Station, College Station, Texas, has published bulletin 62, Heat Requirements of Intermittently Heated Buildings, by Elmer G. Smith, associate professor of physics. It is dated November 1, 1941, but has just been printed.

Prof. Smith stresses the inadequacy of steady state methods when applied to intermittently heated buildings, compares intermittent and continuous heating loads, and describes experimental work on the subject. There is also a section on intermittent cooling. Several tables of absorbances are included, absorbance of a wall being defined as a number which, when multiplied by the product of the desired increase in the indoor air temperature and the surface area of the wall, results in the number of Btu per hr which must be supplied to the wall in order to secure the desired increase of indoor air temperature in a specified time.

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PERFORATION OF ALL METALS

ADJUSTABLE
AIR CONTROL GRILLES
Perfect for Defense Projects!

STANDFORATED Precision Processing provides top quality and super-efficiency at moderate cost. Scientific design, strength and durability meet rigid specifications for all types of Defense Building!

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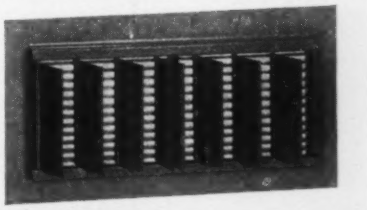

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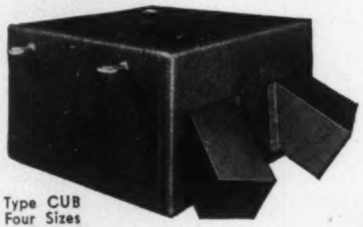

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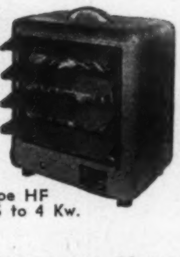

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Postwar Planning for the Construction Industry

The Producers' Council, Inc., 815 - 15th St., N. W., Washington, D. C., has published a 28 p. booklet on postwar planning for the construction industry, which comprises a statement of the need, objectives, and procedures of a program to prepare the industry to do its part in maintaining full employment in the postwar period. Single copies are available from the council on request to anyone connected with the building industry.

Among the topics covered are a significant movement, by Howard Myers; where it started, by F. J. Plimpton; objectives and procedure, by Russell G. Creviston; a national program for private business for the postwar years, by Arthur R. Upgren; the postwar construction market, by S. Morris Livingston; a good example of one company's postwar planning, by Clifford W. Stuart; and what other organizations are doing on postwar planning (a brief list for ready reference).

Effect of Relative Humidity and Temperature on Floor Coverings

Report BMS85 of the National Bureau of Standards is devoted to dimension changes of floor coverings with changes in relative humidity and temperature. It was prepared by Percy A. Sigler, Robert I. Martens and Elmer A. Koerner, and is available from the Superintendent of Documents, Washington, D. C., for 10c.

Changes in relative humidity affect the dimensions of many floor coverings to a much greater extent than do changes in temperature within the range usually en-

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countered in structures. Such floor coverings as strip wood, linoleum, and felt base show a much greater dimensional change in the across grain or across machine direction than in the grain or machine direction. The several monolithic compositions showed relatively small changes in dimensions.

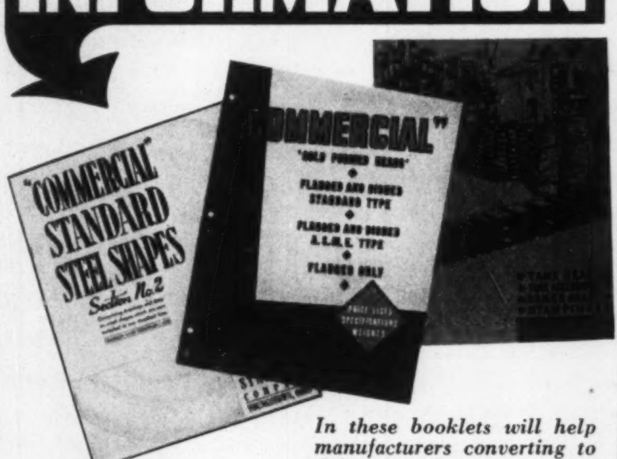
Effective and Dry Bulb Temperatures Confused in Newspaper Article

Writing on fuel rationing in a newspaper magazine supplement, a nationally known doctor made the statement last month that "Repeated group tests show that *97 per cent of us feel most comfortable at an indoor temperature of 66° in the wintertime.*" The statement is an obvious reference to the ASHVE effective temperature chart, and is quite misleading as no mention of "effective temperature" was made.

Effective temperature (says the ASHVE's Heating, Ventilating, Air Conditioning Guide) is an arbitrary index which combines into a single value the effect of temperature, humidity, and movement of air on the degree of warmth or cold felt by the human body. The numerical value is that of the temperature of still, *saturated* air which would induce an identical sensation of warmth.

Thus, it can be seen that a 66 deg effective temperature is not the 66 deg dry bulb temperature which the reader of the doctor's article would infer. At 50 per cent relative humidity, and an air movement or turbulence of 15 to 25 fpm, a 66 deg effective temperature is over 71 deg dry bulb; at lower relative humidities, the dry bulb temperature for 66 deg effective temperature is correspondingly higher.

INFORMATION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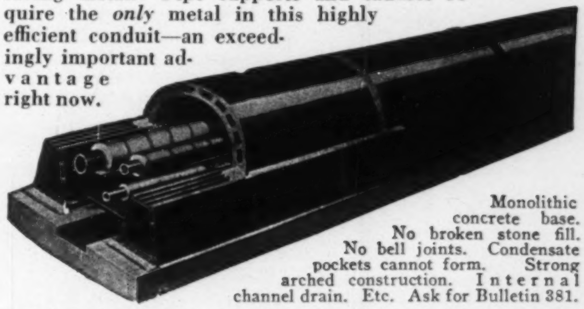

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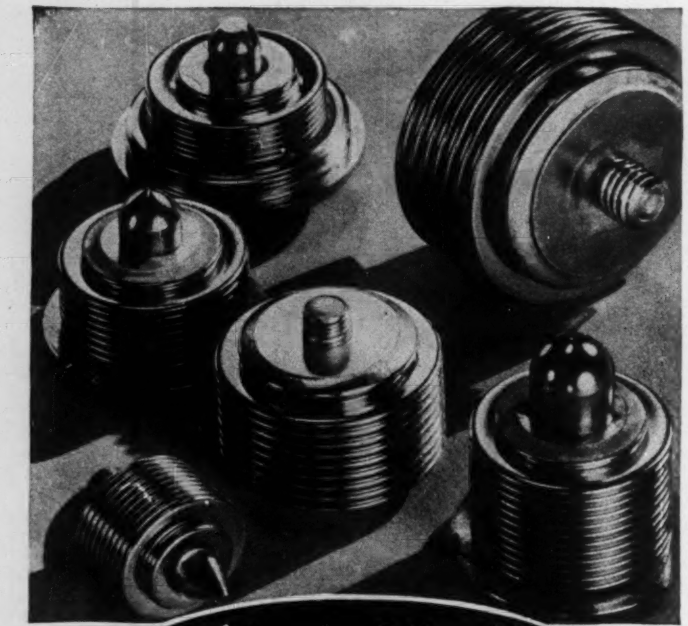
Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective job, on which we shall be glad to have your ☐ comments, ☐ quotations.

Write your name, firm, and address on the margin of this page, tear out with the checked squares above, mail, and you will hear from us promptly.



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Statement of Ownership and Management of HEATING, PIPING & AIR CONDITIONING for October 1, 1942

The following is a statement of ownership, management, etc., as required by the Acts of Congress of August 24, 1912, and March 3, 1933, of Heating, Piping & Air Conditioning, published monthly at Chicago, Ill., for October 1, 1942:

State of Illinois, County of Cook, ss: Before me, a Notary Public in and for the State and county aforesaid, personally appeared F. P. Keeney, who, having been duly sworn according to law, deposes and says that he is the Business Manager of Heating, Piping & Air Conditioning, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher, Keeney Publishing Company, Chicago, Illinois.
Editor, C. M. Burnam, Jr., Chicago, Illinois.
Managing Editor, C. M. Burnam, Jr., Chicago, Illinois.
Business Manager, F. P. Keeney, Chicago, Illinois.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

Keeney Publishing Company, 6 N. Michigan Ave., Chicago, Illinois. Stockholders: F. P. Keeney, Chicago, Illinois; W. J. Osborn, Fairfield, Conn.; R. Payne Wettstein, Chicago, Illinois; Chas. E. Price, Chicago, Illinois; Robert A. Jack, Cleveland Heights, Ohio.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

F. P. Keeney,
Business Manager.

Sworn to and subscribed before me this 16th day of September, 1942.

Grace E. Waymire.
(SEAL) [My commission expires Feb. 10, 1946.]

Coming Events

Health of War Workers

Industrial Hygiene Foundation: Annual meeting, November 10-11, Mellon Institute, Pittsburgh, Pa. Theme of the meeting is to be "Health Arms the War Workers." Among the practical measures urged by the foundation are immediate audits and analyses of absences to determine the amount of time lost from illness and non-industrial injuries, the cause and location; immediate industrial hygiene surveys to locate and eliminate hazards, such as chemical fumes, dusts, etc., endangering the health of workers; modern medical departments within industry, ably staffed and armed with authority to direct employee health protection in all phases. This plan of action will be amplified at the meeting. Headquarters office of the foundation is at 4400 Fifth Ave., Pittsburgh, Pa.

Refrigeration Industry

Conference of Refrigeration Industry: November 19-20, Palmer House, Chicago, Ill. Purpose of this meeting is "to bring the industry together with the sole objective of finding ways and means with government cooperation to assure essential civilian needs, as well as commercial refrigeration, of having suitable maintenance and repair materials on hand for the duration." Sponsored by Refrigeration Equipment Manufacturers Association, 1107 Clark Bldg., Pittsburgh, Pa.

Power Show

15th National Exposition of Power & Mechanical Engineering: November 30-December 4, Madison Square Garden, New York, N. Y. According to the management, exhibitors are planning displays that will help the war production program by showing how to get more out of existing equipment, and ways and means of preventing shutdowns and insuring continuous operation. Under management of International Exposition Co., Grand Central Palace, New York, N. Y.

Refrigerating Engineers

American Society of Refrigerating Engineers: Annual meeting, December 1-2, Hotel Commodore, New York, N. Y. Program includes discussions on recent engineering developments in strato chambers; refrigeration aboard naval vessels; use of refrigeration in manufacture of synthetic rubber; present status of the refrigeration industry; securing refrigeration materials under present regulations; safety valves; specific heat of foodstuffs; refrigeration of foods for transport at sea; and the status of dehydration. Headquarters office of ASRE is at 50 W. 40th St., New York, N. Y.

Warm Air Heating

National Warm Air Heating and Air Conditioning Association: Annual convention, December 8-9, Hotel Cleveland, Cleveland, Ohio. Silver anniversary of warm air research program in cooperation with University of Illinois is to be celebrated, and Dr. Arthur Cutts Willard, president of the U. of I., is to be the guest speaker. Managing director, George Boeddener, National Warm Air Heating and Air Conditioning Association, 145 Public Square, Cleveland, Ohio.

THE EDITOR'S PAGES

IRON AND STEEL ORDER AMENDED

Amendment of the War Production Board's conservation order M-126 to permit use of iron and steel to manufacture repair and maintenance parts for certain equipment — including heating equipment—was announced last month by the director general for operations. This order prohibits the use of iron and steel in the manufacture of upward of 500 groups of civilian articles, and the use of stainless steel for an additional list of products. The whole order has been re-issued to incorporate the amendment.

List C of M-126, which gives certain exemptions from the restrictions for Army, Navy, and Maritime Commission orders, includes air conditioning systems for hospital operating rooms and industrial plants (excluding offices), for use on board ship, for use outside continental limits of the U. S., for use in fortifications, for handling and storage of explosives, for storage and handling of instruments critical to temperature or humidity, for use in gasproofing installations, and for use in mobile surgical vehicles and laboratory vehicles.

Among the other items included in list C are acoustical ceilings for use on board ship; dust collecting systems and equipment; floor and ceiling plates for piping, for use on board ship, for military vehicles, and where climatic or safety conditions make necessary; and certain water tanks for specified uses.

Lead is no longer included on the list of materials which may not be substituted for iron or steel.

List A, prohibiting use of iron and steel, includes humidification devices—except industrial and hospital use; insulation, metal reflecting type; plumbing and heating equipment (gas conversion burners, gas fired boiler-burner units, gas fired furnace-burner units, oil fired boiler-burner units, oil fired furnace-burner units, cold air registers, registers and grilles, and steel heating boilers of 129 sq ft or less of heating surface); tanks (storage, water—except in tropical climates, heights in excess of 100 ft, and range boilers and hot water storage); and ventilators, shutter type.

List S, prohibiting use of stainless steel, includes boiler casings; convectors, local and unit heaters—except heat controls; hot water heaters, tanks and coils; oil burners—except functional parts; oil space heaters; pipe tube, tubing and fittings—except industrial; pumps, fresh water—except industrial; refrigerators and refrigeration equipment—except essential machinery parts; stokers—except functional parts; valve handles; and ventilators.

NEW EDITION OF PIPING CODE APPROVED

The American Standards Association, 29 W. 39th St., New York, N. Y., announced approval last month of the 1942 revision of the American standard code for pressure piping (B31.1). The first edition of this code was approved in 1935. Of wide interest to engineers, the standard covers power piping, gas and air piping, oil piping, district heating piping, refrigeration piping, fabrication details, and materials and identification.

An extensive series of articles on the new code, written by the chairmen of the various subcommittees responsible for its formulation, was published in Heating, Piping & Air Conditioning from January through July, 1942.

CONSERVE HEATING GAS, SAYS WAR BOARD

The WPB appealed recently to consumers to economize in the use of both natural and manufactured gas in order to save critical fuels and transportation and help avert threatened gas shortages.

Herbert S. Marks, acting chief of the WPB power branch, said that because of mounting demands of war industries and the migration of workers to industrial areas, coupled with the inability of gas companies to obtain steel and other critical materials to expand present capacity, many companies already are operating on dangerously low reserves. "That reduced margin could easily be wiped out during periods of extreme cold weather, unless the public conserves both natural and manufactured gas," Mr. Marks said.

CONTROLLED MATERIALS PLAN ANNOUNCED

A long range plan for controlling the flow of critical materials into war production—the controlled materials plan—was announced last month by Donald M. Nelson, chairman of the War Production Board. The main purpose of the plan is to make certain that production schedules are adjusted within material supply so that production requirements are met. This will be accomplished by adjusting requirements for critical materials to the supply, and making the quantity and type of materials needed available at the time required to meet approved programs.

Allotments of critical materials will be made through seven "claimant agencies," such as Army, Navy, Office of Civilian Supply, etc., to prime contractors producing essential goods. Prime contractors, in turn, will divide the allotments with their subcontractors and suppliers.

Carbon and alloy steel, copper, and aluminum—the three most basic and critical materials—are the first "controlled materials" to be directly allotted under the plan, which becomes effective, in its transitory stage, in the second quarter of 1943 and will be in full operation by July 1.

This method of distributing materials is, in effect, "vertical allotment." So far as controlled materials are concerned, it will gradually replace the present priority system, including the production requirements plan, which is on a horizontal basis.

BOILER AND RADIATOR PRICES FIXED

Maximum prices for cast iron coal burning and oil burning boilers and for radiators were fixed November 18 by the Office of Price Administration at levels generally 5 per cent below prevailing prices in the case of boilers and 12 per cent below in the case of radiators.

THE EDITOR'S PAGES

Continued

WPB TIGHTENS FUEL GAS CONTROL

Faced with possible gas shortages in many parts of the country this winter, the War Production Board last month tightened control over the delivery of natural and manufactured gas by revising limitation order L-31 governing natural and mixed gas and limitation order L-174 governing manufactured gas.

"This action was taken because of the increasingly serious gas situation," said Herbert S. Marks, acting chief of the WPB power branch. He emphasized that the revised orders are not in themselves adequate to prevent shortages in many areas, and that supplementary orders and directives dealing with particular localities will be required from time to time.

Principal changes in the orders follow:

Restrictions on new deliveries of gas to non-residential customers are made nationwide in L-31. Previously the restrictions were limited to certain states. November 30 is set as the deadline date for the installation of equipment which may be served in the new territories which have been added to the order. Earlier deadline dates for territories covered by previous orders remain the same. After November 30, WPB approval must be obtained for all new non-residential deliveries, except in the case of replacement of existing equipment.

In the case of residential customers, the prohibition against new gas deliveries will apply after November 30 to all gas heating equipment. Heretofore this prohibition did not affect small unit heaters supplying less than 50 per cent of the heating requirements of the premises. In addition, the area covered by the residential restrictions of the order has been enlarged to include portions of several western states.

After November 30 the installation of gas equipment by both residential and non-residential consumers is prohibited if the delivery of gas for the operation of such equipment is not permitted under the order. This is intended to prevent a waste of critical materials in the installation of gas equipment which cannot be served because of a limited gas supply.

The schedule of curtailment to be followed by gas companies during anticipated shortages is in general continued but is made more detailed. The purpose of the curtailment schedule is to protect war producers and essential civilian services in time of shortage. Whenever necessary, the director general for operations is authorized to require gas companies to curtail deliveries to residential consumers.

L-174, which governs the production and distribution of manufactured gas, has been amended to conform closely to the new provisions of the natural gas order. The principal change is to prohibit the installation of gas equipment in cases where delivery of gas to such equipment is prohibited under the order. In addition, the amendment provides for the submission to WPB of curtailment schedules in advance of anticipated shortages.

BOILER PRODUCTION RESTRICTED

Production of low pressure cast iron boilers built to use exclusively oil or exclusively gas for fuel was prohibited last month by the War Production Board because of the impossibility of converting these to operate with other fuels. Production of other cast iron boilers is prohibited unless they are used for essential purposes. The order, L-187, defines a low pressure cast iron boiler as one designed for hot water or steam heating operated at a maximum working pressure of 15 psi for steam, or 30 psi for water.

Boilers not using exclusively oil or exclusively gas for fuel can be produced only for specified military purposes, or for use in hospitals already constructed or to be constructed in the future. Both of these permitted uses are subject to authorization of the director general for operations on PD-704. Production of repair and replacement parts for any cast iron boiler was not restricted by the action.

PRICE CONTROL FOR CONSTRUCTION INDUSTRY

A new OPA regulation providing specialized price control for the American construction industry was issued October 31 by Price Administrator Leon Henderson. The regulation covers all construction and maintenance services and sales in which contractors, builders, installers, and erectors furnish building or industrial equipment or materials, together with the labor or services required for actual construction, installation, or service.

The pricing provisions of the new regulation are designed to accomplish three things: (1) to maintain the March, 1942, price level (with some exceptions); (2) to afford a workable means for determining a maximum price at this level; and (3) to maintain a constant observation over prices of construction not already under the control of other government agencies in order to disclose any activity where existing controls are not adequately preventing inflationary pricing. Since May, the industry in most instances has been subject to the general maximum price regulation.

ALLOCATION SYMBOLS ABOLISHED

As a further step in eliminating all procedures not justified by final results, WPB on November 6 revoked priorities regulation No. 10. This is the regulation which set up the allocation classification system, requiring that all purchase orders bear designated end-use symbols.

Revocation of the regulation and the system which it established was decided upon by WPB on the basis of experience with it for several months.

FORCES REMOVAL OF COPPER TUBING

The owners of an apartment building and a business man in Washington were recently added to the list of violators of War Production Board orders restricting use of scarce materials to essential war needs.

Among other penalties, all the copper tubing installed in a cooling system in the building must be removed.

LIVAR APPOINTED CHIEF ENGINEER

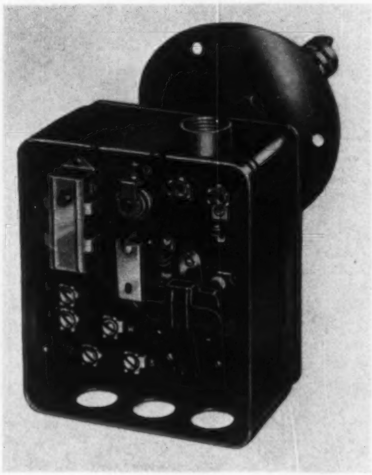
Allen P. Livar has been appointed chief engineer of the Airtemp Division of Chrysler Corp., according to a recent announcement by D. W. Russell, president. Mr. Livar has served Airtemp since 1937 as chief heating engineer and in his new capacity will take over the duties of R. G. Wyld, who has received a Navy commission.

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1942, Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year...Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.

Direct Current Stack Switch

No. 2375—A new direct current stack switch which is not affected by extreme vibrations or by the roll and pitch encountered in marine installations is designated as "Type 648" for intermittent ignition and "Type 647" for continuous ignition. These switches feature "positive arc blowout."



This feature assures protection against excessive arcing and provides long contact life, according to the manufacturer. The load current passes through the arc blowout coil which surrounds a soft iron core to create a magnetic field and thus literally blow out the arc between the contacts.—Penn Electric Switch Co., Box 556, Goshen, Ind.

Two Pen Flow Recorders

No. 2376—Where panel space is limited or where it is desired to have two related flow records on the same chart for comparison, a new two pen electric flow meter may be used. It is actually two complete flow meter receivers mounted within one double depth case.

Both receiver mechanisms can be swung out, and operate in the swung out position. The connection between the rear receiving mechanism and its pen arm must necessarily be detachable and is arranged with a self-aligning v-notch junction.

The integrating feature can be furnished on both mechanisms, but reading the rear mechanism integrator requires opening the case and swinging the front mechanism forward.—Cochrane Corp., 3131 N. 17th St., Philadelphia, Pa.

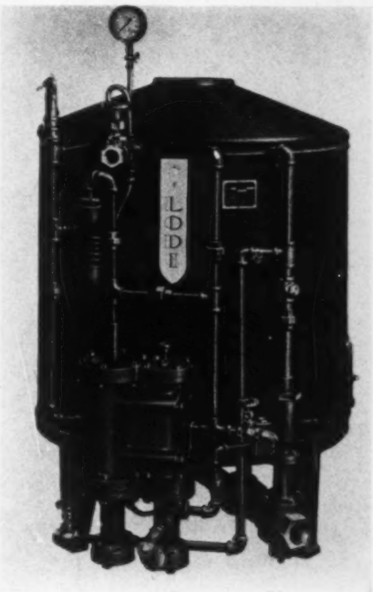
Electroplated Zinc on Steel

No. 2377—A new metal has been added to a line of plated metals—electroplated zinc on steel, which is offered by the manufacturer as a substitute for pure nickel, tin, chromium, aluminum, or stainless. The zinc provides a protective coating to the steel base metal to make a sheet highly resistant to corrosion and rust.

This zinc plated steel can be bent, stamped, formed, drawn, soldered, and spot welded. It is furnished at the present time in sheets only, in sizes up to 36 in. by 96 in. and in a full range of gages and tempers. The thickness of the coating can be varied to meet the requirements and specifications of each application.—American Nickeloid Co., 113 Second St., Peru, Ill.

Steam Generator

No. 2378** — A compact steam generator which needs only fuel and water for automatic operation features a new principle of water feeding which, automatically and without the use of thermostats or motor driven pumps, furnishes feed water in direct proportion to the amount drawn off as steam. Once the generator has been lighted, it is completely operated by the steam throttle valve or the load, according to the manufacturer.



It is stated that the 10 hp model will develop 150 psi pressure from a cold start in less than 5 min. Other models up to 70 hp capacity are to be produced.

Burners are provided for either gas or oil fuel; no pit is required, and no fireboxes or electrical connections need be installed.—Super Mold Corp., 402 N. Sacramento St., Lodi, Cal.

Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [12-42]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Trade Literature.

(Circle each number in which you are interested):

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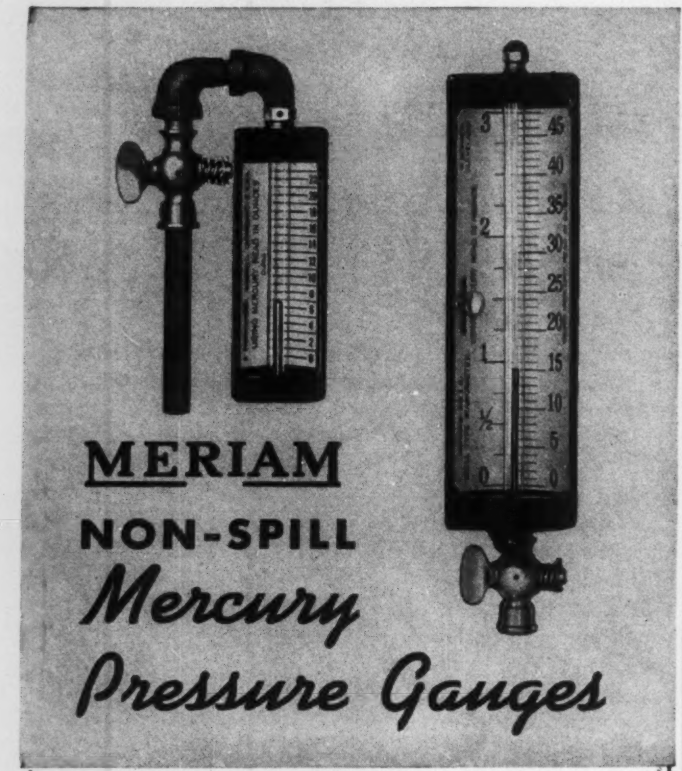
4329 4330 4331 4332 4333 4334 4335 4336 4337 4338
4339 4340 4341 4342 4343 4344 4345 4346 4347 4348
4349

Name .... Title ....

Company ....

Address ....

City .... State............



★ These accurate, compact, direct reading gauges—either as portable or permanent installations—have a wide application for measuring low range air and gas pressures. They are designed so that the mercury cannot be lost from the gauge either through spilling or over-pressuring. They are available in two sizes.

- **MERIAM 3" Mercury Pressure Gauges**
  This range measures to 22 oz. They are $1\frac{5}{16}$" wide, $1\frac{3}{8}$" deep, 4" high and weigh 20 oz. The standard scale reads ounces using mercury. Other scale graduations available.
- **MERIAM 6" Mercury Pressure Gauges**
  These gauges measure up to 48 oz. They are $9\frac{1}{2}$" high, 2" wide, $1\frac{3}{4}$" deep and weigh 1 lb. 8 oz. The scales are graduated on the left of the tube to read from 0 to 3 lbs. by $\frac{1}{4}$ lb. increments, and are graduated on the right of the tube from 0 to 48 oz. by 1 oz. increments. Other scale graduations available.

Housings of the gauges are of cast semi-steel, accurately machined to insure leak-proof fitting of all the component parts. The housing, finished in dull black baked enamel, protects on three sides the heavy walled Pyrex, centrally located tube. Write for Bulletin 3 containing full details.

THE MERIAM COMPANY
1985 West 112th St. Cleveland, Ohio

MERIAM
SINCE 1911
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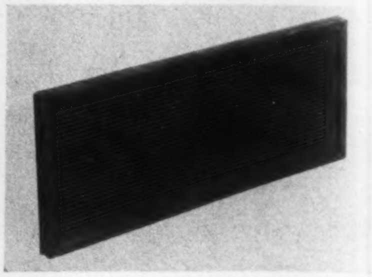
MANOMETERS, METERS AND GAUGES FOR THE ACCURATE MEASUREMENT OF PRESSURES, VACUUMS AND FLOWS OF LIQUIDS AND GASES

Sight Tight Grille

No. 2379—The "Uni-Flo Sight-Tite" grille has been developed to meet a demand for a unit which cannot be seen through at any angle. The fins are of an inverted v shape and overlap, and diffusers on the edges of the fins add rigidity and improve appearance.



This grille is useful for ventilation openings in doors, walls, panels, baseboards, etc., and may also be used for exterior air intake openings as it provides a barrier to rain or snow.

Sizes run up to and including 36 in. x 36 in., with larger sizes prefabricated in two or more sections and assembled in a common frame.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 127. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Alloy Steel Data Sheet

No. 4329—2 p. chart showing analysis, physical characteristics, and applications of 19 different stainless steel, "Monel," and nickel alloys.—Cooper Alloy Foundry Co., 200 Bloy St., Hillside, N. J.

Balance Loader System

No. 4330—12 p. catalog (B-L342) on the balance loader system for modulating refrigeration system capacities from 0 to 100 per cent of full load and maintaining a fixed minimum back pressure in the suction line and in the compressor crankcase.—Kramer Trenton Co., 626 Brunswick Ave., Trenton, N. J.

Blow Torches

No. 4331—Wall chart, entitled Know Your Blow Torch, illustrating the various parts of the blow torch and showing how to light it.—Turner Brass Works, 823-47 Park Ave., Sycamore, Ill.

Centrifugal Compressors

No. 4332—20 p. catalog (386-2) describing and illustrating line of "Design 9" centrifugal compressors for application wherever blowers for smaller capacity work are required. These compressors are available in over 200 sizes with pressures from ½ to 3 psi, volumes to 5500 cfm.—B. F. Sturtevant Co., Damon St., Hyde Park, Boston, Mass.

Copper and Copper Alloys

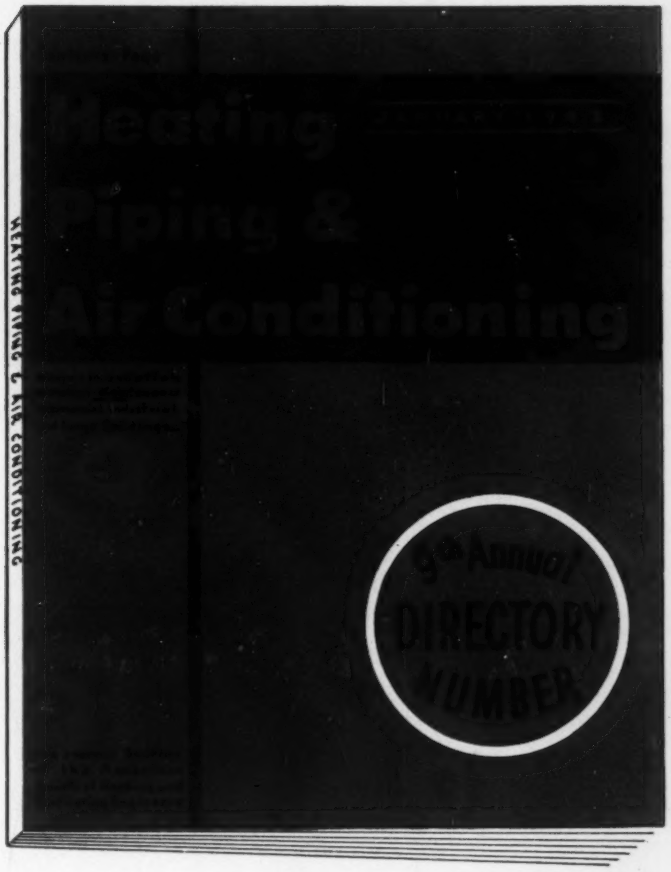
No. 4333—Comprehensive guide book of factual information on copper and copper alloys, indexed and organized for easy reference and giving data on tech-

LAST CALL!

HEATING, PIPING & AIR CONDITIONING'S

JANUARY 1943

ANNUAL DIRECTORY NUMBER


HEATING PIPING & AIR CONDITIONING
Heating Piping & Air Conditioning
9th Annual
DIRECTORY
NUMBER

It'll be out next month! HEATING, PIPING & AIR CONDITIONING'S NINTH ANNUAL DIRECTORY NUMBER will give the industry a complete listing of "who makes it," and "where they are located."

Reaching thousands of high priority buyers, this issue is read, kept and referred to throughout the year making it an ideal spot to advertise your products to the people who are buying NOW . . . and it also offers an excellent opportunity for you to perpetuate your trade marks for the year to come.

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TRADE MARKS REG. U. S. PAT. OFF.
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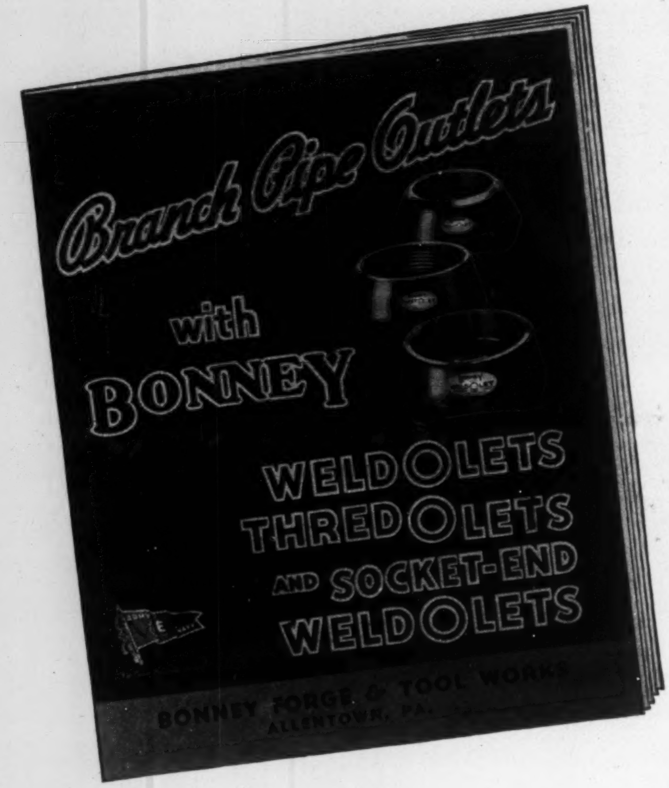
Welded Outlets for Every Piping System

Get Your Copy of this New Catalog Now



JUST off the press, this new 16 page Bulletin WT31 covers more thoroughly and completely than any previously issued information, the advantages of Bonney WeldOlets, ThredOlets and Socket-End WeldOlets in all types of piping systems.

It tells in detail, their purpose; what they are; how you can make right-angle welded branch pipe outlets stronger, better and at less cost; how they will reduce turbulence and friction in piping systems; how to make a right-angle branch pipe outlet in six easy steps; how they fill every piping need whether indoors or outside, above or below ground and whether for new construction or maintenance; their wide variety of applications; their adaptability to manufactured products and shop fabrication as well as complete tables of specifications and dimensions.

Awarded to the Men and Women of Bonney Forge & Tool Works "for great accomplishment in the production of war equipment".

If you use or expect to use pipe fittings for welding, you need this book. Write for it today . . . Bulletin WT31.

BONNEY FORGE & TOOL WORKS
FORGED FITTINGS DIVISION
ALLENTOWN, PA.

nology and properties, welding technique, specifications, manufactured forms, pipe and tube dimensions, and weights.—Revere Copper and Brass, Incorporated, 230 Park Ave., New York, N. Y.

Humidifiers in Industry

No. 4334—8 p. bulletin describing the application of humidification in a wide variety of industries and the benefits it provides. Data are included on the use of humidification for the control of dust, lint, and static electricity, and for adding to human comfort.—Armstrong Machine Works, 874 Maple St., Three Rivers, Mich.

Industrial Plant Maintenance

No. 4335—Wartime maintenance digest describing new cleaning materials, descaling methods, and related techniques. Among the topics treated are cleaning air conditioning equipment, water treatment for air conditioning, cleaning air filters, descaling ammonia condensers, cleaning fuel oil heaters and nozzles, removing carbon from gas burners, preventing rust in hydraulic systems, descaling refrigerating equipment, cleaning steam heaters, cleaning unit heaters, and many others.—Oakite Products, Inc., 22 Thames St., New York, N. Y.

Measuring and Control Instruments

No. 4336—16 p. bulletin (Z6100) giving condensed listing of complete line of measuring and control instruments.—Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill.

Motor Selector Chart

No. 4337—"Motor Finder" for quickly selecting the various types of squirrel cage motors, enabling the user to match the conditions under which the motor must operate with the required motor characteristics, in three simple steps. Over 30 standard types of motors covering a horsepower range from ½ to 75 are included. —Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Pipe Joint Compound

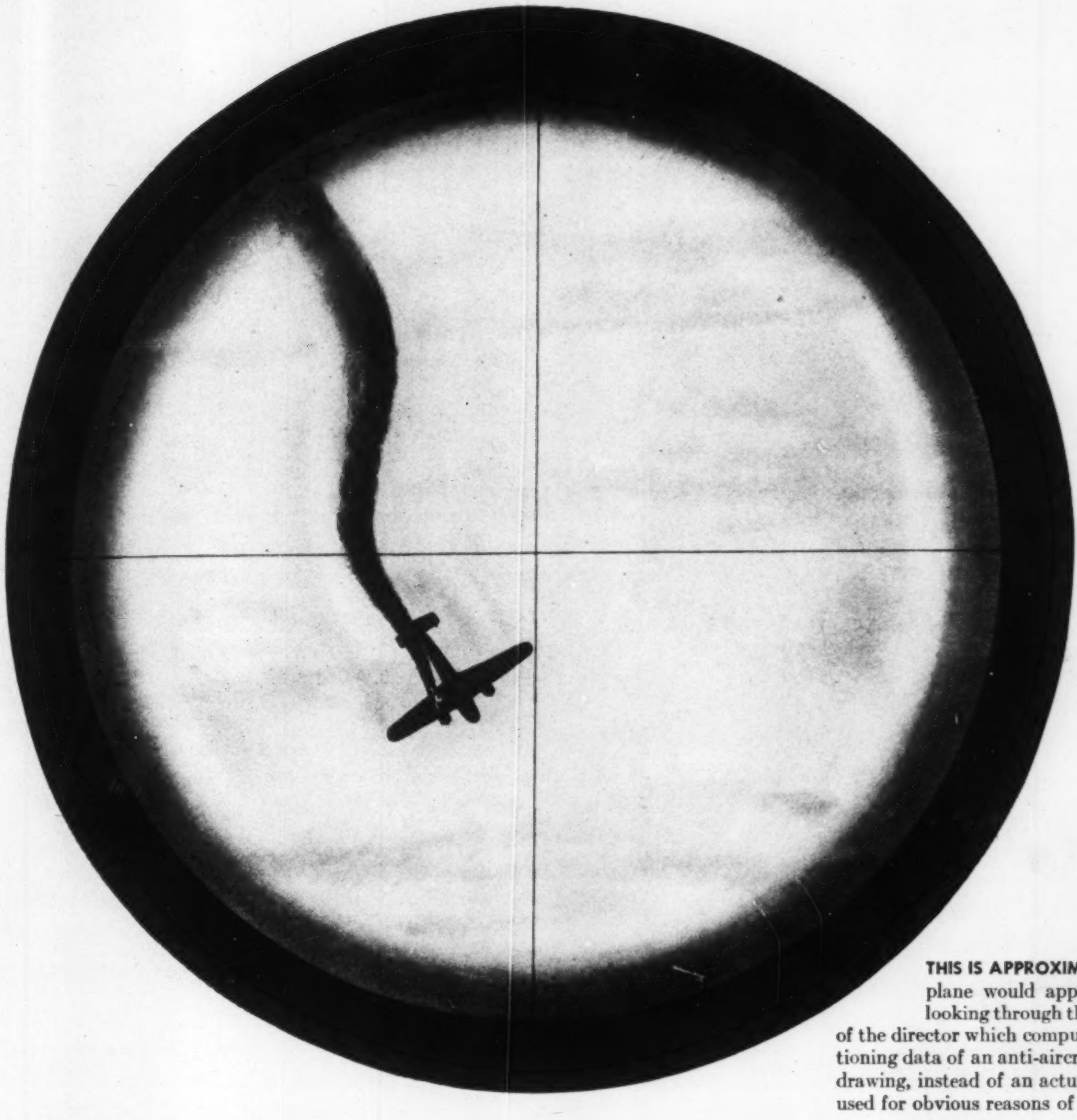
No 4338—Folder outlining features of pipe joint compound not only as a substitute for litharge and glycerin but as an improvement over this combination. This compound is offered for use in ammonia, brine, oxygen, and "Freon" lines and is said to work perfectly as a seal for all types of joints in all types of metal pipe.—X-Pando Corp., 43-15 36th St., Long Island City, N. Y.

Refrigeration Parts and Supplies

No. 4339—144 p. catalog (138) of refrigeration parts and supplies, covering a complete line and carefully indexed. Also, a supplemental bulletin (138-A) of bargains. Much information on ordering under war conditions is given.—Harry Alter Co., Inc., 1728 S. Michigan Ave., Chicago, Ill.

Resistance Thermometers

No. 4340—46 p. catalog (N-33C) on "Micromax" resistance thermometers for measurement and control.—Leeds & Northrup Co., 4970 Stenton Ave., Philadelphia, Pa.



THIS IS APPROXIMATELY how a Jap plane would appear, if you were looking through the telescopic sight of the director which computes the gun positioning data of an anti-aircraft battery. This drawing, instead of an actual photograph, is used for obvious reasons of military secrecy.

Memo to maintenance engineers about dust

THE ACCURACY of a gun sight can make all the difference between a dead Jap pilot and a Jap bomb hit.

That such gun sights are accurate depends on superb design, materials, assembly, engineering skill, and the dust-free rooms in which such gun sights are made.

Helping keep air dust-free in one factory where gun sights are made is the job of Fiberglas* Dust-Stop* Air Filters.

This use dramatizes how important dust-free air has become in war industries and is indirectly a reminder to maintenance engineers in charge of air-conditioning systems about the importance of replacing filters on schedule.

Most automatic telephone exchanges operate with a minimum of wrong numbers and no "frying noise" during conversation because this intricate mechanism works in air filtered by Dust-Stops.

In paint spray booths, where whole 4-engine bombers are spray painted after assembly, workmen are shielded from noxious fumes and the explosion hazard is greatly reduced by circulating a large volume of Dust-Stop filtered air.

Dust-Stops remove process dusts in grinding operations from factory air; in shell loading and powder plants Dust-Stops contribute to cleanliness and safety.

In scores of war industries, Dust-Stops are doing yeoman service in connection with air conditioning and ventilating systems. Maintenance men are keeping their systems near top operating condition at low cost by vacuum cleaning filter intake faces or by rapping out heavy dust accumulations. They also find Dust-Stops easy to change, requiring no special tools or skills. Replacements are made quickly without hindrance to continuous operation.

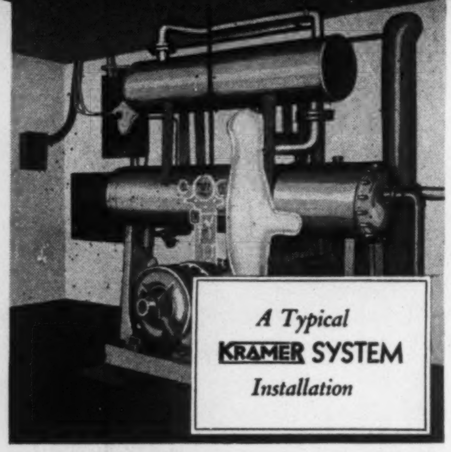
If your regular supplier cannot give you costs and maintenance data on Dust-Stops, write us. *Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

FIBERGLAS*
DUSTOP*
AIR FILTERS

*T. M. Reg. U. S. Pat. Off.

KRAMER
Balance Loader
SYSTEM

The Greatest Achievement
IN REFRIGERATION CONTROL
SINCE THE INTRODUCTION OF
THE THERMOSTATIC
EXPANSION VALVE



A Typical
KRAMER SYSTEM
Installation

The KRAMER Balance Loader SYSTEM (Patented) is a modulating refrigeration system capable of varying from 0% to 100% of full load, and maintaining a fixed minimum back pressure in the suction line and in the compressor crank case.

The KRAMER SYSTEM will automatically compensate for varying evaporator loads, resulting in an infinite number of compressor capacity points, giving straight line capacity modulation.

The KRAMER SYSTEM is the only one that will give a full range of modulation at a fixed minimum back pressure throughout the entire low side.

The KRAMER SYSTEM can be applied to new or existing refrigeration installations

Send for Catalog BL-342

KRAMER TRENTON Co.
MANUFACTURERS OF
Heat Transfer Products
TRENTON, N. J.

THE AXIS WANTS YOUR BUSINESS
GIBBONS

THIS is more than a war of mechanical monsters clashing in the night . . . more than a war of production.

It is a war for markets—*your* markets! The Axis wants your business—wants to destroy it for once and all.

With so much at stake, there is no doubt you will want to do everything you can to meet this Axis threat. Two ways are open: Speed production and BUY BONDS. The only answer to enemy tanks and planes is *more* American tanks and planes—and your regular, month-by-month purchases of Defense Bonds will help supply them. Buy now *and keep buying.*

- HOW THE PAY-ROLL SAVINGS PLAN HELPS

When you install the Pay-Roll Savings Plan (approved by organized labor), you not only perform a service for your country but for your *employees.* Simple to install, the Plan provides for regular purchases of Defense Bonds through voluntary pay roll allotments.

Write for details *today!* Treasury Department, Section R, 709 Twelfth Street, NW., Washington, D. C.

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Bonds ★ Stamps

This space is a contribution to Victory by
HEATING - PIPING
and AIR CONDITIONING

Rheostats

No. 4341—4 p. bulletin on pressed steel rheostats which are 4 in. in diameter and are rated for 100 watts.—Ward Leonard Electric Co., 37 South St., Mt. Vernon, N. Y.

Sanitary Pumps

No. 4342—4 p. bulletin (115) on sanitary pumps used in food and beverage processing plants, describing their features and giving specifications.—Blackmer Pump Co., 1920A Century Ave., S. W., Grand Rapids, Mich.

Solenoids

No. 4343—2 p. data sheet describing solenoids designed for hydraulic valves and general industrial purposes.—Dean W. Davis & Co., Inc., 549 W. Fulton St., Chicago, Ill.

Steam Hose

No. 4344—2 p. catalog section (4500) of simple rules for care and maintenance of steam hose.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Valves

No. 4345—168 p. catalog (42) on bronze valves, iron valves, fire protection valves, blowoff and quick operating plug valves, and unions, flange unions, and union fittings. Complete information, dimensions, and list prices are presented and there is a section of useful engineering data, decimal equivalents, etc.—Fairbanks Co., 393 Lafayette St., New York, N. Y.

Ventilation

No. 4346—8 p. pictorial booklet showing the use of self-cooled motor propeller fans, universal blowers, and unit heaters in both world war I and world war II.—Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.

Welding

No. 4347—Bulletin (168) describing application of low temperature welding for joining turns of steel refrigeration coils. Also, bulletin (182) giving instructions for use of alloy arc rod for welding cast iron.—Eutectic Welding Alloys Co., 40 Worth St., New York, N. Y.

Welding Electrodes

No. 4348—Issue of Welding Briefs (Vol. 3, No. 5) including information on how to conserve electrodes by selection of proper joint.—Metal & Thermit Corp., 120 Broadway, New York, N. Y.

Wrought Iron Pipe and Plates

No. 4349—Series of instruction booklets and charts which comprise an industrial refresher course to increase efficiency in the handling of wrought iron and thus save metal. There are bulletins on bending and flanging wrought iron pipe, threading wrought iron pipe, bending wrought iron plates, welding and flame cutting wrought iron, and wall charts on correcting threading ills and welding wrought iron.—A. M. Byers Co., Clark Bldg., Pittsburgh, Pa.

FOR LOW-COST HEATING, QUICK INSTALLATION
AND METAL CONSERVATION

DIRECTHERM
UNIT HEATERS
STOKER-FIRED

It is a self-contained unit and can be installed or moved in a few hours. No duct work, radiators, or pipes are necessary.

To tend a Directherm requires a minimum of attention. Once the automatic controls are set, they need not be changed. An unskilled man can take care of it . . . important in these days of labor shortage.

Made in 6 sizes (300,000-1,700,000 BTU).

AIRTHERM
MANUFACTURING COMPANY
706 S. SPRING AVE. · ST. LOUIS, MO.

Useful Information

Prices Set for Selling Air Conditioning Equipment for War Use

Owners of large scale air conditioning and refrigeration equipment who sell this machinery for use by war industries will be paid the total cost, less depreciation, but including the full cost of original installation, the Office of Price Administration announced last month.

The War Production Board is urging department stores, hotels, office buildings, and other enterprises to sell such equipment, since new production cannot meet all the needs of war industries. Since the sellers of this equipment will be patriotically sacrificing its use for the duration of the war, OPA ruled that they should be fully reimbursed.

The action, contained in amendment No. 55 to maximum price regulation No. 136 (machines and parts and machinery services), provides that the maximum price for these sales shall be the installation costs of the equipment to the user plus the original cost less depreciation at the rate of 5 per cent per year. This is the generally accepted depreciation rate recognized by the United States Treasury in its purchases.

The conversion program calls for the purchase of this machinery *by its manufacturers*, who will then recondition it for the use of the plant to which WPB has allocated it. The OPA action, which became effective November 27, permits the manufacturer to recover his total expenses, including inspection, dismantling, rebuilding and reconditioning, shipping and installation costs. In addition the manufacturers may add any out-of-pocket expenses incurred in such transactions plus a reasonable charge for engineering and risk and responsibility.

Manufacturers' charges for risk and responsibility and for engineering will be reviewed by OPA, as all manufacturers are required to submit a report of the transaction and the amount of profit to OPA. Unless OPA disapproves the transaction within 30 days, the price at which it is sold by the manufacturer will be considered to be automatically approved.

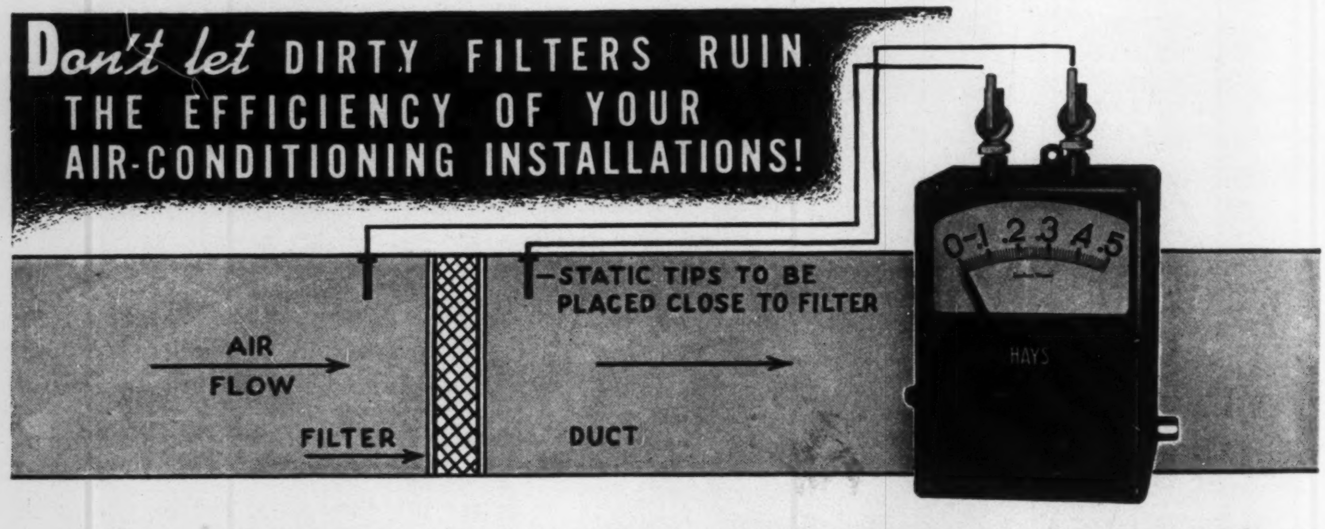
Price Regulations for Conversion to Coal

Because of the more extensive and critical need for conversion of heating boilers from oil to coal, the Office of Price Administration revised its price regulation on conversion parts last month to bring it in line with trade practices established as the new conversion industry has grown to major proportions.

Cost increases, reflecting freight charges at the manufacturer's level and relieving the squeeze on the wholesale and retail levels, will result in an increase of approximately 6 per cent. This will mean an average increase of $1.50 to $2.00 on the conversion parts necessary to convert a residential oil fired heating boiler to the use of hand fired solid fuels, according to OPA.

These changes are contained in revised maximum price regulation No. 236 — heating boiler conversion parts — issued and effective November 25.

At the same time, certain special new combination


Don't let DIRTY FILTERS RUIN THE EFFICIENCY OF YOUR AIR-CONDITIONING INSTALLATIONS!
—STATIC TIPS TO BE PLACED CLOSE TO FILTER
AIR FLOW
FILTER
DUCT
0 .1 .2 .3 .4 .5
HAYS

Dirt clogged filters in any air-circulating system mean reduced efficiency and added power costs. On the other hand, changing filters oftener than necessary is downright waste.

With a HAYS Air-Filter gage installed in a duct you know precisely, at all times, the condition of the filter and Static tips, installed on either side of the filter bank supply a differential air-flow measurement which is indicated on a scale in the remotely mounted gage. If desired, the gage may be made to flash or sound an alarm when filter resistance becomes excessive. And it is also furnished when wanted with electric contacts to operate a damper to control the flow of air through the duct.

The HAYS Air-Filter Gage employs the famous slack-leather diaphragm pressure measuring element and is of the high quality in design, materials and workmanship that has made Hays Gages internationally famous. The price is reasonable. Write us at 990 Eighth Avenue for Publication 40-278.

The HAYS CORPORATION
COMBUSTION INSTRUMENTS AND CONTROLS
MICHIGAN CITY, INDIANA, U.S.A.

conversion units were priced specifically as such at dollars and cents maximum prices installed and sales of parts weighing 10 lb or less were excluded from the revised regulation and put under maximum price regulation No. 188, which sets manufacturers' ceiling prices on specified building materials, and the general maximum price regulation. This was done because the new units did not lend themselves to weight pricing and because the sales of 10 lb or less were found to be largely repair rather than conversion sales.

There is no change in the geographical area covered by the revised regulation insofar as it applies to regular conversion parts. However, the revised regulation does establish maximum prices for special combination units nationwide. The area covered by maximum price regulation No. 236 includes the states of Connecticut, Delaware, Florida, Georgia, Maine, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia, West Virginia, and the District of Columbia for the sales of regular conversion parts—and the whole United States for special combination grate units.

In other sections of the country installations are governed by maximum price regulation No. 251, covering the construction industry.

Specific Heats of Gases

The Specific Heats of Certain Gases Over Wide Ranges of Pressures and Temperatures is the title of bulletin No. 30, a recent publication of the Cornell University engineering experiment station. The gases are air, carbon dioxide, carbon monoxide, ethylene, hydrogen, methane, nitrogen, and oxygen; the temperature range is from 0 to 4000 F; and the pressure range is from 0 to 10,000 psi.

This bulletin gives the general equations which determine the effect of pressure on the specific heats of the gases, within ranges of temperature and pressure encountered most frequently in engineering practice. For the gases considered in this paper, the variations of specific heats with temperature and pressure are also shown graphically.

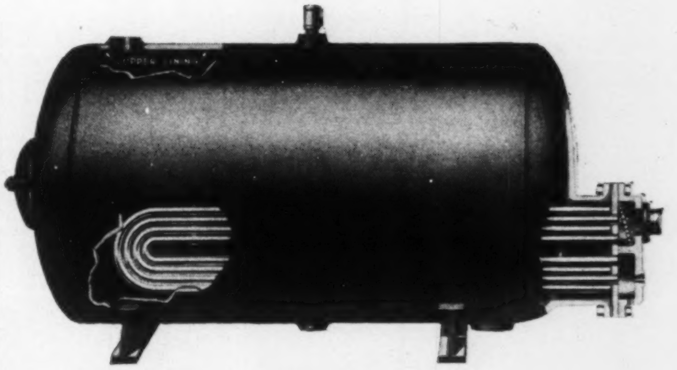
The authors of this bulletin are Frank O. Ellenwood, John Edson Sweet professor of engineering and head of the department of heat-power engineering, Nicholas Kulik, formerly McMullen graduate scholar in the Sibley school of mechanical engineering, and Norman R. Gay, John Edson Sweet research associate, all of Cornell University.

Single copies of this bulletin may be secured without charge by writing to the Engineering Experiment Station, Cornell University, Ithaca, N. Y. The price for additional copies sent to the same person is 50c.

Spot Conditioning Speeds War Production

With the tightening of critical materials, many new plants are, of necessity, air conditioning only vital areas instead of the entire plant, according to L. W. Clifford, of Westinghouse Electric and Mfg. Co. For example, an airplane plant recently erected a duplicate factory except for the 6000 hp air conditioning plant. Instead, the plant uses several small scattered air conditioning units for essential production spots.

"Spot" air conditioning is increasingly used for such



A GOOD INVESTMENT IN '39

a Prime Asset Today

Sounds unbelievable, but it wasn't so long ago that Patterson-Kelley was manufacturing—and delivering!—both *copper-lined* and *Solid Everdur* Hot Water Storage Heaters. And it's a pretty safe bet these units now in use are as good as new today! With good care, a Patterson Hot Water Storage Heater—lined with copper or built of Solid Everdur—will give years of dependable, trouble-free service. Think of what that means! A piece of equipment that has every chance of out-lasting the war—and then some. Plenty of hot water . . . and no *replacement* worries!

Of course, we're still making Patterson Hot Water Storage Heaters. But deliveries are subject to priority ratings. Even those units fabricated from *steel* are in the top priority class. Unless your priority rating warrants it, you'll have to wait until after the war to order a Patterson Heater. But when you do — remember how forcibly World War II *underscored* sound equipment values. For the last word in *serviceability*, specify *Everdur* or *copper-lined* in that post-war Patterson Hot Water Storage Heater—in that order!

PATTERSON-KELLEY *FOR DEPENDABLE, ECONOMICAL SERVICE*

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THE *Patterson-Kelley* CO., INC.

107 WARREN ST., EAST STROUDSBURG, PA.

FACTORIES FIND EXTRA VALUE IN SUSPENDED GAS HEATERS

AND now in the industrial field, Reznor Unit Heaters have proved themselves outstanding. Yes, their ability to deliver lots of warm air over wide areas is one of the reasons. But, delivering heat from a suspended position, above the working zone, also helps to make Reznor Heaters valuable to production management.

Reznor Unit Heaters may be easily and quickly installed—with lower installation costs. This type heating equipment also uses 89% less vital materials than cast radiation systems. You'll find it worth-while to investigate. Write for catalog U 42.

REZNOR MANUFACTURING CO.
305 JAMES STREET, MERCER, PENNA.

"THOSE REZNOR HEATERS MOVE A LOT OF WARM AIR"

GAS HEATERS EXCLUSIVELY SINCE 1888

things as special manufacturing processes, laboratories, testing rooms, and store rooms for instruments and perishable supplies. Often, individual self-contained units are applied up to 25 tons. For higher capacities a central system may be required.

Spot conditioning of special manufacturing areas is essential to much war production. A typical case is in holding constant temperature and humidity while cutting marine propulsion gears. At one plant, each of the precision hobbing machines is in a separate insulated room; the rooms are air conditioned by 25 units ranging from 2½ to 5 tons.

Holding constant temperature throughout the continuous 17 day gear cutting period maintains the close tolerances. Similarly, low relative humidity prevents condensation on the gear and tools. From two to four men work in each room and outside air is introduced, mixed with room air, and brought through the air handling unit to provide a proper working atmosphere. The internal design conditions are 75 F dry bulb, held within ± 1 F, and approximately 60 per cent relative humidity.

The rooms are of double steel construction with insulation between the walls. Each air conditioning unit has a heating and cooling coil; 13 evaporative condensers are used for condensing purposes.

This is but one of the hundreds of industrial processes where this spot air conditioning serves war production. It is flexible, easy to install, and adaptable to practically any process where a control of temperature and relative humidity are required, according to Mr. Clifford.

STOP THAT DRIP

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

APPLY WITH BRUSH, TROWEL OR SPRAY

A SURE CURE

● This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition. Permanently protects metal against rust and corrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.

Stucco-like finish requires no maintenance and can be painted any color. A gallon covers about 30 feet of 1" O.D. pipe. Comes in 1, 5 and 55 gallon drums.

Immediate Shipment. Order from your Supply House. Write for **NoDrip Handbook.**

J. W. MORTELL CO.
Technical Coatings Since 1895
512 Burch Street, Kankakee, Illinois

OPA Order Allows Retailers to Curtail Air Conditioning

The OPA issued November 25 a supplementary order authorizing the curtailing of many peacetime retail services without reductions in ceiling prices. Among the "services performed without relation to a specific sale" which the order allows curtailing or discontinuing, are "instruction classes, style shows, store decorations, free concerts, free refreshments, and air conditioning."

Welding and Its Application

A new book, Welding and Its Application, by Boniface E. Rossi, director of the welding division of the Delehanty Institute, was recently published. Its object is to familiarize the beginner with certain fundamental facts concerning the welding process, to give the experienced welding operator a wider understanding of the process, and to provide a source of reference on welding.

There are chapters on welding and its economy; practical applications of welding in manufacturing, construction, and maintenance; welding terms and their definitions; a study of the different welding processes and their basic principles; the electric arc and its application to the welding process; arc welding equipment; technique of arc welding; weldability of various metals by arc welding; expansion, contraction, and residual stresses in welded structures; welding jigs; metallurgy of welding; testing and inspection of welds; flame and arc cutting of metals; welding symbols and their use;

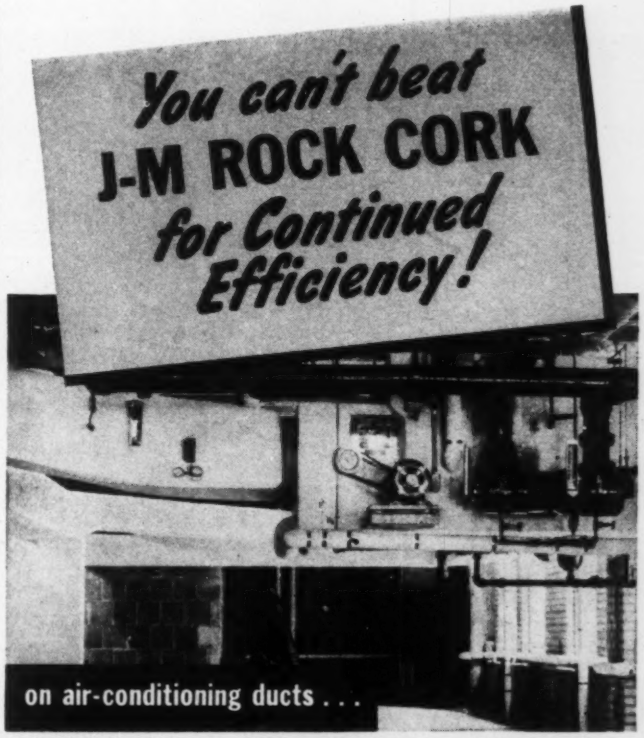
Waterloo
AIR DIFFUSION EQUIPMENT

- Adjustable Directional Grilles
- Louvres . . . Vanes . . . Diffusers
- Dampers . . . Ventilators

. . . reflecting the fine craftsmanship and design that have characterized Waterloo products for over 40 years.

WATERLOO REGISTER CO.
Waterloo, Iowa Seattle, Wash
Representatives in Principal Cities

CONTROL OF SELECTION SIZE THROW VOLUME DIRECTION



on air-conditioning ducts . . .

on pipe lines . . .

THAT'S NOT JUST A CLAIM. It's a statement of fact based on more than 25 years of outstanding performance on scores of jobs.

The explanation . . .

Rock Cork is basically mineral. This means complete freedom from rot and decay . . . strict sanitation . . . no trouble with vermin . . . the end of moisture and mold problems!

You'll find, too, that installation is economical, for Rock Cork is easily, quickly applied. And year after year, it retains its high efficiency—maintenance costs are practically zero. For details, write for brochure DS-555. Johns-Manville, 22 East 40th Street, New York, N. Y.

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ROCK CORK
Low-Temperature Insulation
In Sheet Form and for Pipe Covering

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FIGURE YOUR AIR FILTER COST *by the year*

. . . not by the unit

Years of long life without need of replacements . . . that's the secret of the economy of AIR-MAZE permanent washable air filters. Even though they cost a bit more *per unit* than conventional "throwaway" filter panels the difference in cost is usually made up in a year or less.

After that they still have a life expectancy of 10 to 15 years . . . all pure velvet on the cost side, except for the minor expense of occasional cleaning. For AIR-MAZE filter panels can be cleaned *again and again* to make them like new with all their original performance characteristics.

Add to this the advantage of their superior efficiency . . . *better than 99% by actual test* (practical dust) . . . and you have the important reason for the growing popularity of AIR-MAZE panels for every air filter need. *Approved by the Underwriters' Laboratories.*

Write for interesting data on the economy of AIR-MAZE air filter panels.

AIR-MAZE CORPORATION
5200 HARVARD AVE. CLEVELAND, OHIO

AIR-MAZE
DEPENDABLE AIR FILTERS FOR EVERY APPLICATION

and an appendix containing useful engineering data and tables.

The publisher is the McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y., and the price of this book is $2.50.

How to Conserve V Belt Drives

The engineering research bureau of the Multiple V-Belt Drive Association, 140 S. Dearborn St., Chicago, Ill., has prepared a 16 page booklet on 23 ways to conserve the life of multiple v belt drives. It is a contribution to the rubber conservation movement and its sole purpose is to educate users in the proper procedure of selection, installation, and maintenance of v belt drives in order to obtain maximum life out of every belt.

This book "is not an academic engineering handbook, but a simply written and well illustrated primer" on the subject. It is offered free of cost to those who request it from the Multiple V-Belt Drive Association.

Constructing Gas Pipe Line

The way in which unusual obstacles were surmounted in the construction of the gas pipe line from Lirette, La., to Mobile, Ala., was described in a paper presented before the annual meeting of the American Society of Mechanical Engineers by W. B. Poor, supervising engineer of the United Gas Pipe Line Co.

The pipe line had to cross the Mississippi River, Lake Pontchartrain, which is 25.5 miles wide at that point, and 65 other streams and canals. The major part of the land traversed by the line consists of reclaimed marshes and heavily timbered swamps, and special prob-

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HODGMAN

Saran Tubing by Hodgman is a tough thermoplastic specially made to replace strategic materials such as aluminum, stainless steel, nickel, copper, brass, tin and rubber. It is adaptable for use under high working and bursting pressures and is resistant to most chemicals. Its insulating qualities, flexibility and ease of handling make it extremely valuable in installations requiring the transport of oil, gas, air, water and corrosive chemicals . . . Flare type fittings of the same material make it possible to install a complete system with no more tools than a sharp knife and a flaring tool.

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lems were presented by the corrosive nature of the soils, and the fact that the waters were infested with barnacles and marine borers.

The weather provided additional hazards, said Mr. Poor. Construction commenced early in July, but the first pipe was not received until August 28, and September is a "hurricane month" in southern Louisiana. The original welding yard was flooded due to high tides caused by a tropical hurricane and had to be moved to a baseball park. During the 45 days of construction on the critical Lake Pontchartrain crossing, three storms caused a loss of 13 days' time. However, despite all unfavorable conditions, the entire project was completed and placed in service early in February, 1942.

Particular interest was aroused by Mr. Poor's description because of the pending construction of an oil pipeline from the producing fields of Texas to the east.

Repair of Bombed Gas Mains

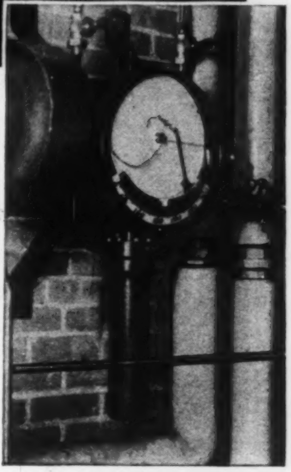
Wartime, with its ever present possibility of air raids, imposes special problems in the emergency repair of gas mains, according to C. S. Goldsmith, of the Brooklyn Union Gas Company, in a paper presented at the annual meeting of the American Society of Mechanical Engineers. Three months before Pearl Harbor the engineers of the company began planning ways of shutting off the gas flow and making emergency repairs to gas mains if a severe bombing should disrupt service.

Valves have always been provided on all high pressure mains to shut off the gas, but on low pressure mains the expense of installing valves at each street intersection is so great that temporary means of gas

√ Accurate
√ Convenient
√ Complete

. . . That's the story behind the success of HEATING, PIPING AND AIR CONDITIONING's Annual Directory, published each January. Its completeness, accuracy and convenience have made it indispensable to engineers and contractors throughout the year for reliable reference in their buying and specifying work. Reserve your space in it now!

KEENEY PUBLISHING COMPANY
6 North Michigan Ave. Chicago, Ill.



LET THIS METER HELP
STRETCH YOUR STEAM

● The unprecedented demand for steam, coupled with the difficulty of obtaining new generating equipment, makes it essential to stop waste and squeeze every pound of steam from present generating equipment.

To do this most effectively, you need ADSCO Steam Flow Meters. They provide information that will enable you to

1. Establish the proper load distribution among boilers.
2. Center attention on the department or unit using excess amounts of steam.
3. Coordinate steam consumption with steam production.

In these ways, it may be possible to regulate your steam supply sufficiently to carry you through this critical period.

ADSCO Steam Flow Meters record and totalize on direct reading evenly divided charts, with exceptional accuracy at all rates of flow. They can be used for steam, water, compressed air or gas.

Write us regarding your meter problems—also, ask for Bulletin No. 35-83-HP.

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NORTH TONAWANDA N. Y.
MAKING "UP-TO-DATE" STEAMLINE EQUIPMENT FOR OVER 60 YEARS

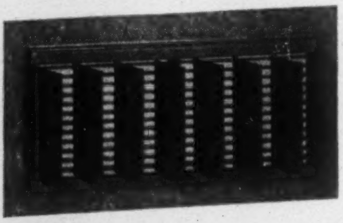
LET ADSCO FLOW METER
TELL YOU HOW MUCH . . . WHEN . . . WHERE

SPECIFY
STANDFORATED
PERFORATION OF ALL METALS
ADJUSTABLE
AIR CONTROL GRILLES
Perfect for Defense Projects!

STANDFORATED Precision Processing provides top quality and super-efficiency at moderate cost. Scientific design, strength and durability meet rigid specifications for all types of Defense Building!

QUALITY
EFFICIENT
VOLUME
CONTROL
REGISTERS

No. 500HA — 4-Way Deflection. Vertical deflecting louvres on back individually operated left or right. Horizontal grille bars on face adjustable in groups for up or down deflection.



STANDARD
STAMPING & PERFORATING COMPANY
3151 W. 49th PLACE • CHICAGO, ILLINOIS

WRITE FOR CATALOG
STANDFORATED GRILLES
BEND-EZY REGISTERS
INDUSTRIAL & ORNAMENTAL
PERFORATIONS & STAMPINGS

shutoff are used. These means are not suitable in wartime because of the different conditions obtaining. If a cast iron main should break in normal times, the rupture is circumferential and only a small crack results. Since the main is 3 ft under the surface and completely surrounded by well packed soil, the escaping gas is so greatly retarded that the emergency is not acute. In such a case it is necessary merely to expose the main at the break, install a clamp and backfill, with no interruption of service. In air raids, however, an exploding bomb will remove a large section of the main, permitting gas to escape in large quantity from both ends. Furthermore, as learned from the experience of England, the gas is almost sure to be ignited.

Mr. Goldsmith described four methods of shutting off gas under such conditions, with minimum danger to the repairman. He then described how best to restore the ruptured main for the resumption of service. In peacetime one break only is usually encountered, but during a raid dozens of breaks might be produced and peacetime methods of permanent repair are too slow. Mr. Goldsmith described a speedy and practical emergency repair joint.

Electrode Conservation

If vital war production is not to be impeded by lack of arc welding electrodes, cooperation of electrode manufacturers and users to make the most of the electrode being produced is essential. So said H. O. Westendarp, welding engineer of the General Electric Co., in a talk last month before the Cleveland section of the American Welding Society.

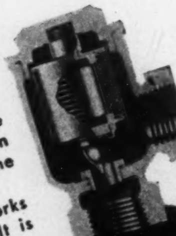
GUARDING
INDUSTRY'S
COAL PILE

Fuel is 1/3 the transport tonnage in the U. S. A. Dead condensate or air in a steam coil wastes fuel and slows up production.

The Sarco Steam trap illustrated on this page says "get out" to spent condensate and gases — and "wait a while" to anything above its discharge temperature.

It is so inexpensive that it can be used on each steam coil, so no one part of the job can hold up another. Also it's wide open when cool — giving a quick start in the morning. Obviously it cannot freeze.

It is small, light, easy to install and works on all pressures within three ranges. It is the only thermostatic steam trap made for pressures up to 250 lbs. Ask for Catalog No. 250.



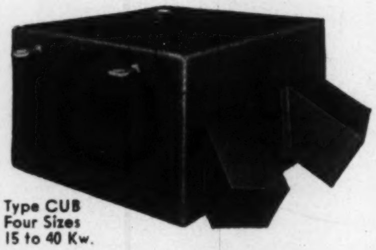
Sarco No. 9
Thermostatic
Steam Trap

144

SARCO
SAVES STEAM

SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
Sarco Canada Ltd., Federal Bldg., Toronto, Ont.

Warmth for Workers
anywhere, any time!



Type CUB
Four Sizes
15 to 40 Kw.

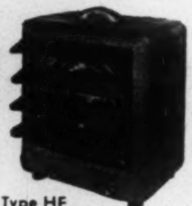
Electric heat eliminates cold spots — provides adequate warmth for hard-to-heat places — keeps overtime workers comfortable, even with boilers shut down. Reduce man losses resulting from colds and keep employees healthy with easily-installed, economical

CHROMALOX
Electric
AIR HEATERS

These units have no "quitting time" • Give instant warmth wherever needed • Can be installed anywhere—in remote gate house as well as main office or shop • Make no demand on overloaded boilers • Supply quickly installed heat for new shops or offices • Require no piping • Correct deficiencies in main heating plant • Permit early spring shut down of main heating system.

Types for every need. Write for Chromalox Catalog of Electric Heat. Use our help in figuring required sizes, types and operating cost.

Type UB
2 to 15 Kw.



Type HF
1.5 to 4 Kw.

Heat supplied by the famous Chromalox Electric heating units, used in industry for process heat in every application.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh, Pa.

He suggested the following program as a guide:

Select largest diameter and greatest length electrode that can be applied successfully. This not only speeds up deposition rates of weld metal, but also results in a decided increase in the tonnage of electrode that can be extruded per day from existing facilities.

Joints to be welded must have good fit up—excessive gaps are prolific wasters of metal.

Use proper amperage for the job—avoid excessive currents and long arcs. There is a current beyond which deposition rate is decreased and electrode consumption increased.

Don't bend electrodes except where absolutely necessary. Bent electrodes destroy electrode coating and result in excessive stub losses.

Produce true fillet welds having equal legs—this is a function of proper type of electrode and welding technique.

Use each electrode down to point where full coating diameter ends.

Another point that should be kept in mind, Mr. Westendarp stated, is that electrode inventories should be utilized and stub ends converted as rapidly as possible.

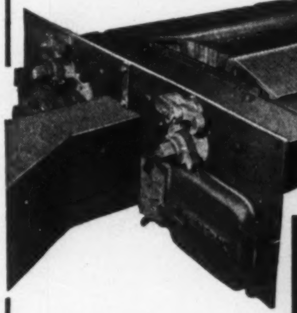
Chicago War Housing Code

The ordinance passed by the Chicago city council on August 5, prescribing construction requirements for new dwellings in defense districts, has been issued in pamphlet form.

The pamphlet contains 34 pages, and includes property standards; minimum planning requirements; minimum construction, heating, plumbing and sanitation, and electric requirements; drawing and permit requirements; and appendices covering maximum spans, definitions, and building materials and equipment standards.

Copies may be purchased in the Municipal Reference Library, Room 1005, City Hall, Chicago, for 15c.

FULL ACTIVE GRATE SURFACE
WITHOUT DEAD PLATES



Frederick
STOKERS

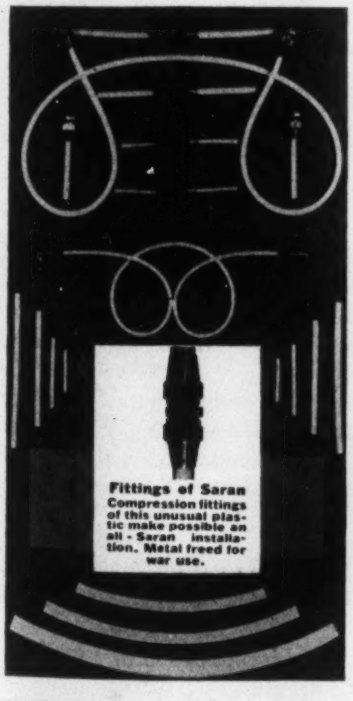
MAINTAINS A LOW
COMBUSTION RATE
PER SQ. FT. OF AREA

★ More grate area, but low combustion rate per square foot of area! . . . Frederick Stokers have specially designed tuyeres with air ports so arranged and proportioned as to insure correct air distribution and maximum efficiency in combustion. Enclosed wind-boxes with two clean-out doors, another exclusive Frederick feature, eliminate possible air leakage through brickwork. . . .

YES. NEW FREDERICK STOKERS ARE DIFFERENT. A long list of original features distinguish them; many common stoker problems are solved by them. We suggest you write for complete description. Just send a note on your letterhead to

The FREDERICK IRON & STEEL COMPANY
EAST & 7TH STS., FREDERICK, MD.
BUILDERS OF FINE STOKERS FOR OVER 24 YEARS
BUY WAR BONDS

Non-Metallic TUBING of SARAN



Fittings of Saran Compression fittings of this unusual plastic make possible an all - Saran installation. Metal freed for war use.

For Air Conditioning Uses

In Saran an answer is found to restrictions on metal tubing which threaten the production of air conditioning units for civilian buyers. This Acadia Thermoplastic Tubing stands heat up to 175° F. and freezing without bursting . . . resists acids, carries both high and low pressures, and cannot corrode or scale. Acadia can supply Saran Tubing of various sizes and wall thicknesses. Let our engineers furnish full information. Write us.

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SYNTHETIC PRODUCTS
DIVISION

WESTERN FELT WORKS (Licensee of THE DOW CHEMICAL COMPANY)
4039 Ogden Avenue, Chicago, Illinois
BRANCH OFFICES IN ALL PRINCIPAL CITIES

4/5ths of the Y.M.S. MINESWEEPERS
DEPEND ON Westco PUMPS
for BOTH fresh and salt water supply

...and they are equally efficient in YOUR plant!

When fighting ships put to sea, they can't take chances with equipment breakdowns. Particularly in smaller vessels where repair facilities are limited and there's no room for standby equipment, absolute dependability is VITAL!

That's why it is doubly significant that in *four out of every five* YMS Minesweepers, Westco Pumps have been given the job of handling BOTH fresh and saltwater supplies. In addition, Westcos are going into Troop Ships, Sub-Chasers, Tankers, Coast Guard Cutters, and other naval vessels.

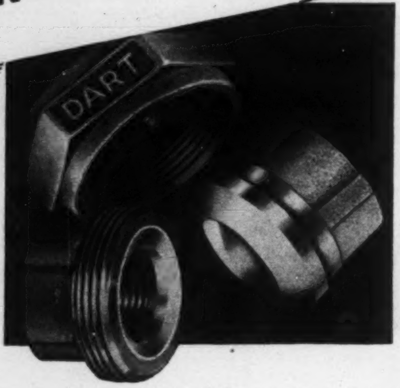
What better testimony is there to the amazing stamina, high efficiency, and rugged dependability built into Westco Pumps?

TAKE A TIP FROM THE NAVY. When you buy pumps for YOUR plant, remember—*you can't beat Westco performance!*

On Westco Pumps, wear and corrosion are taken by renewable liners. To renew pump, simply renew liners!

POMONA PUMP CO.
WESTCO DIVISION
2621 LOCUST STREET • ST. LOUIS, MISSOURI

Don't Scrap
USED
DART UNIONS



Put them Back to Work

Your country needs all your *scrap* . . . but NOT the things that your plant can use again to good advantage, such as old Dart Unions.

Even though a Dart has already given *plenty* of fine service, it can be put back on the job . . . *with tight-joint performance.* And the reasons *why* Darts can do this are found in the way Darts are MADE: their matched bronze seats, ground to "true-ball" surfaces . . . their air refined malleable iron bodies and nuts that resist rust and rough handling.

Today, you *need* your used Dart Unions—don't throw them away. And when you need *new* ones, get in touch with your supplier promptly.

E. M. DART MFG. CO., Providence, R. I.

DOES NOT STAIN HANDS or FIXTURES

Take a tip from other master piping contractors and plant engineers and use Rutland Pipe Joint Cement on every job. It seals joints tightly—lasts indefinitely—yet always leaves pipes easy to disjoin. Legal for use in all cities because no toxic ingredients. Remains soft in can.
Mail post card for free sample. Rutland Fire Clay Company, Department H-12, Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patcher.

RUTLAND
PASTE PIPE JOINT CEMENT
RUTLAND FIRE CLAY CO
RUTLAND, VT.

Additional Restrictions on Fuel Oil Where Conversion Is Possible

Reflecting the continued seriousness of the fuel oil supply situation in the east coast area, OPA on November 13 ordered additional restrictions in the issuance of fuel oil rations for equipment which may be converted to the use of coal.

Henceforth, oil burning equipment furnishing heat or heat and hot water for apartments, office buildings, institutions, and similar structures will be regarded as convertible to an alternate fuel unless satisfactory proof to the contrary is furnished. Rations for fuel oil will be issued, as formerly, until conversion is completed but this period of grace now is limited to the end of the second heating period. The second heating period varies somewhat between the four thermal zones but terminates about January 20 in most.

To insure that rations are not allotted to convertible equipment, local rationing boards will review all rations issued for heat or heat and hot water to multiple dwellings. In instances where satisfactory proof is not established that conversion is impossible, rations which have been issued for the entire heating year will be revoked and fuel oil allotted only for the period necessary to accomplish conversion. Local boards will determine whether "satisfactory proof" has been presented, such proof being defined by OPA as instances where "the materials necessary for such conversion are not on hand and that the required labor is not available and that such materials and labor can be obtained only with unreasonable difficulty or expense, or that an alternate fuel is not available."

Up to the present, equipment has not been regarded as convertible if the applicant claimed sufficient materials and labor could not be secured, the cost of conversion was unreasonably high, or an alternate fuel was not available. This arrangement has not been satisfactory, however, as local boards do not have sufficient time or information to investigate.

These changes are contained in amendment No. 7 to the fuel oil rationing regulations.

Coming Events

Warm Air Heating

National Warm Air Heating and Air Conditioning Association: Annual convention, December 8-9, Hotel Cleveland, Cleveland, Ohio. Silver anniversary of warm air research program in cooperation with University of Illinois is to be celebrated, and Dr. Arthur Cutts Willard, president of the U. of I., is to be the guest speaker. Managing director, George Boeddener, National Warm Air Heating and Air Conditioning Association, 145 Public Square, Cleveland, Ohio.

Foundry War Production

American Foundrymen's Association: 47th annual meeting, April 28-30, Hotels Jefferson and Statler, St. Louis, Mo. Meeting is to be a "mobilization of management, technical, and operating men for devising ways and means for extending use of cast metals in the war effort." Headquarters office of the AFA is at 222 W. Adams St., Chicago, Ill.

SECTION OF JANUARY, 1942, HEATING + PIPING AND AIR CONDITIONING

1942 DIRECTORY

of

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT

for

INDUSTRY AND LARGE BUILDINGS

PART 1—PRODUCTS CLASSIFIED—Page 240

If you want to know the names of one or more manufacturers making a certain product, look in Part I, where products are classified alphabetically in "directory style" with the noun governing (for instance, "unit heaters" are listed under "heaters, unit").

PART 2—TRADE NAMES—PAGE 299

If you have the trade name of a product and want to know who manufactures it, look in Part 2, where trade names are alphabetically listed. Trade names the same as or indentifiable from the company name are not listed. Manufacturers with such trade names can be easily identified under their product classifications in Part I.

PART 3—MANUFACTURERS' ADDRESSES—Page 312

For the complete name and address of any manufacturer look in Part 3.

● The manufacturers whose names are spotted throughout the listings advertise in this issue. See Index to Advertisers (on last page) for the page on which you will find the advertising of any of these manufacturers.

Heating, Piping and Air Conditioning
Chicago, Illinois

DIRECTORY SECTION

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS

PART 1—PRODUCTS CLASSIFIED

ABSORPTION DEHUMIDIFIERS

See Dehumidifiers, Absorption and Adsorption

ABSORPTION REFRIGERATION MACHINES

See Machines, Refrigeration, Absorption

ACCUMULATORS, REFRIGERATION (FOR AIR CONDITIONING)

Acme Industries, Inc., Jackson, Mich.
American Injector Co., Detroit, Mich.
Betz Air Conditioning Corp., Kansas City, Mo.
Boester, Carl F., St. Louis, Mo.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Frick Co., Waynesboro, Pa.
●McQuay, Inc., Minneapolis, Minn.
Richmond Engineering Co., Inc., Richmond, Va.
●Vilter Mfg. Co., Milwaukee, Wis.
X L Refrigerating Co., Chicago, Ill.

ADJUSTABLE WRENCHES

See Wrenches, Adjustable

ADSORBERS, ODOR

Airox Co., New York, N. Y. (Chemical for counteracting odors)
Betz Corp., Hammond, Ind.
Carbide and Carbon Chemicals Corp., New York, N. Y.
●Connor Engineering Corp., W. B., Dorex Div., New York, N. Y.

ADSORPTION DEHUMIDIFIERS

See Dehumidifiers, Absorption and Adsorption

AFTERCOOLERS, COMPRESSED AIR

Adams Co., Inc., R. P., Buffalo, N. Y.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Locomotive Co., Alco Products Div., New York, N. Y.
Andale Co., Philadelphia, Pa.
Annis Air Filters, Glendale, Cal.
●Bell & Gossett Co., Morton Grove, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Ingersoll-Rand, New York, N. Y.
Johnson Corp., Three Rivers, Mich.
Parks-Cramer Co., Fitchburg, Mass.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Ruemelin Mfg. Co., Milwaukee, Wis.
Schutte & Koerting Co., Philadelphia, Pa.
Tippett & Wood, Phillipsburg, N. J.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Zallea Brothers & Johnson, Wilmington, Del.

AIR AFTERCOOLERS

See Aftercoolers, Compressed Air

AIR BREAK FITTINGS

See Fittings, Drainage, Fixed Air Break

AIR CLEANERS

See Cleaners, Air, Electrical

AIR COMPRESSORS

See Compressors, Air

AIR CONDITIONERS

See Units, Air Conditioning

AIR CONDITIONING UNITS

See Units, Air Conditioning

AIR DIFFUSERS

See Diffusers, Air, High Velocity; Grilles; Registers

AIR ELIMINATORS

See Eliminators, Air

AIR FILTER GAGES

See Gages, Air Filter

AIR FILTERS

See Filters, Air

AIR SEPARATORS

See Separators, Air

AIR VALVES

See Valves, Radiator, Air

AIR VELOCITY METERS

See Meters, Air Velocity, Direct Reading; Anemometers

AIR WASHERS

See Washers, Air

ALARMS, HIGH AND LOW BOILER WATER

Johnson Corp., Three Rivers, Mich.
Kieley & Mueller, Inc., New York, N. Y.
●McDonnell & Miller, Chicago, Ill.
Morehead Mfg. Co., Detroit, Mich.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.
●Yarnall-Waring Co., Philadelphia, Pa.

ALARMS, SMOKE

Au-Temp-Co Corp., New York, N. Y.
Bailey Meter Co., Cleveland, O.
Boiler Room Equipment, Inc., New York, N. Y.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Preferred Utilities Mfg. Corp., New York, N. Y.
Weston Electrical Instrument Corp., Newark, N. J.
Worner Products Corp., Chicago, Ill.

ALUMINUM SHEETS

See Sheets, Aluminum

ANALYZERS, CARBON DIOXIDE, PORTABLE

Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Barclay, Inc., Robert, Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Dwyer Mfg. Co., F. W., Chicago, Ill.
Ellison Draft Gage Co., Chicago, Ill.
Engelhard, Inc., Chas., Newark, N. J.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●Hays Corp., Michigan City, Ind.
Hotstream Heater Co., Cleveland, O.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Permutit Co., New York, N. Y.
Precision Control Co., San Francisco, Cal.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Preferred Utilities Mfg. Corp., New York, N. Y.
Service to Industry, West Hartford, Conn.
Weaver Mfg. Co., Springfield, Ill.

ANEMOMETERS

American Instrument Co., Silver Spring, Md.
Barclay, Inc., Robert, Chicago, Ill.
Bristol Co., Waterbury, Conn.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
Hill, E. Vernon, Chicago, Ill.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
●Taylor Instrument Companies, Rochester, N. Y.
Willson Products, Inc., Reading, Pa. (Thermometer type)

ANGLE VALVES

See Valves, Angle

ANGLES, BARS, BEAMS, CHANNELS AND TEES (LIGHT WEIGHT SHAPES)

Aluminum Co. of America, Pittsburgh, Pa.
●American Brass Co., Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Brasco Mfg. Co., Harvey, Ill.
●Byers Co., A. M., Pittsburgh, Pa.
Carnegie-Illinois Steel Co., Pittsburgh, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
Columbia Steel Co., San Francisco, Cal.

● Advertisement in this issue. See Index to Advertisers, page 326.

Inland Steel Co. Chicago, Ill.
International Steel Co., Evansville, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
Lukens Steel Co., Coatesville, Pa.
Milcor Steel Co., Milwaukee, Wis.
Republic Steel Corp., Cleveland, O.
Revere Copper and Brass, Incorporated, New York, N. Y.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Truscon Steel Co., Youngstown, O.
Weirton Steel Co., Weirton, W. Va.
●Youngstown Sheet & Tube Co., Youngstown, O.

AQUASTATS

See Thermostats

ARC WELDERS

See Welders, Arc

ARC WELDING ELECTRODES

See Electrodes, Arc Welding

ASBESTOS FIBER AND CEMENT PIPE

See Pipe, Asbestos Fiber and Cement

ASBESTOS PACKING

See Packing, Asbestos

BALANCING VALVES

See Valves, Balancing

BALL BEARINGS

See Bearings, Ball

BAROMETRIC CONTROLS

See Controls, Draft, Barometric

BASES, MOTOR, TENSION ADJUSTING

Ackermann Mfg. Co., Wheeling, W. Va.
Alexander Bros., Philadelphia, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
●General Electric Co., Schenectady, N. Y.
Ideal Commutator Dresser Co., Sycamore, Ill.
Manley Products Corp., York, Pa.
Rockwood Mfg. Co., Indianapolis, Ind.

BASES AND PADS, VIBRATION ISOLATING

Armstrong Cork Co., Lancaster, Pa.
●Buffalo Forge Co., Buffalo, N. Y.
Butterworth, B. T., Jr., New Canaan, Conn.
●Clarage Fan Co., Kalamazoo, Mich.
Cork Import Corp., New York, N. Y.
Cork Insulation Co., Inc., New York, N. Y.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Felters Co., Inc., Boston, Mass.
Firestone Tire & Rubber Co., Akron, O.
Gates Rubber Co., Denver, Col.
Goodrich Co., B. F., Akron, O.
Keldur Corp., New York, N. Y.
Korfund Co., Long Island City, N. Y.
Lord Mfg. Co., Erie, Pa.
Manley Products Corp., York, Pa.
●Mundet Cork Corp., Brooklyn, N. Y.
National Lead Co., New York, N. Y.
United Cork Companies, Lyndhurst, N. J.
United States Rubber Co., New York, N. Y.
Vibration Eliminator Co., Astoria, N. Y.
●Western Felt Works, Chicago, Ill.

BEARINGS, BALL

Ahlberg Bearing Co., Chicago, Ill.
Bantam Bearings Corp., South Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Dodge Mfg. Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., Indianapolis, Ind.
Marlin-Rockwell Corp., Jamestown, N. Y.
New Departure Div., General Motors Sales Corp., Bristol, Conn.
Nice Ball Bearing Co., Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
●SKF Industries, Inc., Philadelphia, Pa.
Schatz Mfg. Co., Fairview, Poughkeepsie, N. Y.
Shafer Bearing Corp., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Torrington Co., The, Torrington, Conn.
Wood's Sons Co., T. B., Chambersburg, Pa.

BEARINGS, PILLOW BLOCK

Ahlberg Bearing Co., Chicago, Ill.
Air Controls, Inc., Cleveland, O.
Caldwell Co., W. E., Louisville, Ky.
Central Die Casting & Mfg. Co., Inc., Chicago, Ill.
Chain Belt Co., Milwaukee, Wis.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Clizbe Bros. Mfg. Co., Plymouth, Ind.
Dick Co., Inc., R. & J., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
General Motors Corp., Moraine Products Div., Dayton, O.
Goldens' Foundry & Machine Co., Columbus, Ga.
Hastings Air Conditioning Co., Hastings, Neb.
Jeffrey Mfg. Co., Columbus, O.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Lau Blower Co., Dayton, O.
Link-Belt Co., Indianapolis, Ind.
Maple City Stamping Co., Peoria, Ill.
Medart Co., St. Louis, Mo.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
●Randall Graphite Products Corp., Chicago, Ill.
Royersford Foundry & Machine Co., Inc., Royersford, Pa.
●SKF Industries, Inc., Philadelphia, Pa.
Schwitzer-Cummins Co., Indianapolis, Ind.
Shafer Bearing Corp., Chicago, Ill. (self aligning)
Smith, Inc., Winfield H., Springville, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Triangle Mfg. Co., Oshkosh, Wis.
Viking Air Conditioning Corp., Cleveland, O.
Wood's Sons Co., T. B., Chambersburg, Pa.

BEARINGS, ROLLER

Ahlberg Bearing Co., Chicago, Ill.
Bantam Bearings Corp., South Bend, Ind.
Dodge Mfg. Corp., Mishawaka, Ind.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Link-Belt Co., Indianapolis, Ind.
Medart Co., St. Louis, Mo.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Trenton, N. J.
Royersford Foundry & Machine Co., Inc., Royersford, Pa.
●SKF Industries, Inc., Philadelphia, Pa.
Shafer Bearing Corp., Chicago, Ill. (self aligning)
Timken Roller Bearing Co., Canton, O.
Torrington Co., The, Torrington, Conn.
Wood's Sons Co., T. B., Chambersburg, Pa.

BEARINGS, SLEEVE

Dodge Mfg. Corp., Mishawaka, Ind.
Federal-Mogul Corp., Detroit, Mich.
General Motors Corp., Moraine Products Div., Dayton, O.
Johnson Bronze Co., New Castle, Pa.
Keystone-Carbon Co., Inc., St. Marys, Pa.
Medart Co., St. Louis, Mo.
Motex Metal Process Corp., Detroit, Mich.
●Randall Graphite Products Corp., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wood's Sons Co., T. B., Chambersburg, Pa.

BELLOWS, THERMOSTATIC

●Bishop & Babcock Mfg. Co., Cleveland, O.
Bridgeport Thermostat Co., Inc., Bridgeport, Conn.
Cashin Co., W. D., Boston, Mass.
●Clifford Mfg. Co., Boston, Mass.
Cook Electric Co., Chicago, Ill.
●Fulton Sylphon Co., Knoxville, Tenn.

BELTING, FLAT, LEATHER

Alexander Bros., Inc., Philadelphia, Pa.
Chicago Belting Co., Chicago, Ill.
Graton & Knight Co., Worcester, Mass.
Houghton & Co., E. F., Philadelphia, Pa.
●Rhoads & Sons, J. E., Philadelphia, Pa.
Schieren Co., Chas. A., New York, N. Y.
Williams & Son, I. B., Dover, N. H.

BELTING, FLAT, RUBBER

Boston Woven Hose & Rubber Co., Cambridge, Mass.
Continental Rubber Wks., Erie, Pa.
Dick Co., Inc., R. & J., Passaic, N. J.
Firestone Tire & Rubber Co., Akron, O.
Garlock Packing Co., Palmyra, N. Y.
●Gilmer Co., L. H., Philadelphia, Pa.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Hamilton Rubber Mfg. Co., Trenton, N. J.
Jeffrey Mfg. Co., Columbus, O.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Manheim Mfg. & Belting Co., Manheim, Pa.
Quaker Rubber Corp., Philadelphia, Pa.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
Rockwood Mfg. Co., Indianapolis, Ind.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
United States Rubber Co., New York, N. Y.

BELTS, V

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
Chicago Belting Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Dayton Rubber Mfg. Co., Dayton, O.
Dick Co., Inc., R. & J., Passaic, N. J.

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Dodge Mfg. Corp., Mishawaka, Ind.
Firestone Tire & Rubber Co., Akron, O.
Gates Rubber Co., Denver, Colo.
●Gilmer Co., L. H., Philadelphia, Pa.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Manheim Mfg. & Belting Co., Manheim, Pa.
Medart Co., St. Louis, Mo.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
Rockwood Mfg. Co., Indianapolis, Ind.
Schieren Co., Chas. A., New York, N. Y.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
United States Rubber Co., New York, N. Y.
Wood's Sons Co., T. B., Chambersburg, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

BENDERS, PIPE

American Pipe Bending Machine Co., Inc., Boston, Mass.
American Pipe Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Bernz Co., Inc., Otto, Rochester, N. Y.
Blackhawk Mfg. Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Crown Die & Tool Co., Chicago, Ill.
Greenlee Tool Co., Rockford, Ill.
Holsclaw Bros., Inc., Evansville, Ind.
Hossfeld Mfg. Co., Winona, Minn.
●Mueller Brass Co., Port Huron, Mich.
●O'Neil-Irwin, Inc., Minneapolis, Minn.
Pedrick Tool & Machine Co., Philadelphia, Pa.
Toledo Pipe Threading Machine Co., Toledo, O.
Vanderman Mfg. Co., Willimantic, Conn.
Wallace Supplies Mfg. Co., Chicago, Ill.
●Watson-Stillman Co., Roselle, N. J.

BENDERS, TUBING

American Pipe Bending Machine Co., Inc., Boston, Mass.
Armstrong Mfg. Co., Bridgeport, Conn.
Bernz Co., Inc., Otto, Rochester, N. Y.
●Buffalo Forge Co., Buffalo, N. Y.
Greenlee Tool Co., Rockford, Ill.
Hays Mfg. Co., Erie, Pa. (Copper Tube)
Holsclaw Bros., Inc., Evansville, Ind.
Hossfeld Mfg. Co., Winona, Minn.
Imperial Brass Mfg. Co., Chicago, Ill.
Martin & Sons, H. P., Owensboro, Ky.
●O'Neil-Irwin, Inc., Minneapolis, Minn.
Parker Appliance Co., Cleveland, O.
Pedrick Tool & Machine Co., Philadelphia, Pa.
Perfection Refrigeration Parts Co., Harvey, Ill.
Sac Tool Mfg. Co., St. Louis, Mo.
Snap-On Tools Corp., Kenosha, Wis.
Wallace Supplies Mfg. Co., Chicago, Ill.

BENDS, EXPANSION, STEAM PIPE

American Locomotive Co., Alco Products Div., New York, N. Y.
Crane Co., Chicago, Ill.
Flori Pipe Co., The, St. Louis, Mo.
●Grinnell Co., Inc., Providence, R. I.
Harris & Co., Arthur, Chicago, Ill. (Stainless & non-ferrous)
Harrisburg Steel Corp., Harrisburg, Pa.
Kellogg Co., M. W., The, New York, N. Y. (Corrugated steel)
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden & Van Stone Co., South Boston, Mass.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Pipe Bending Co., New Haven, Conn.
National Valve & Mfg. Co., Pittsburgh, Pa.
Ohio Pipe Bending & Machine Co., Cleveland, O.
Parks-Cramer Co., Fitchburg, Mass.
Pittsburgh Pipe Coil & Bending Co., Etna, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
●Ric-wiL Co., Cleveland, O.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Shaw Co., Benjamin F., Wilmington, Del.
Shaw-Kendall Engineering Co., Toledo, O.
Walworth Co., New York, N. Y.

BI-METALS, THERMOSTATIC

Chace Co., W. M., Detroit, Mich.
General Plate Div., Metals & Controls Corp., Attleboro, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wilson Co., H. A., The, Newark, N. J.

BLADES, PROPELLER FAN

Ackermann Mfg. Co., Wheeling, W. Va.
Aerovent Fan Co., Piqua, O.
Air Controls, Inc., Cleveland, O.
Aire-Foile Fan & Blower Co., Detroit, Mich.
Airmaster Corp., Chicago, Ill.
Allen Corp., Detroit, Mich.
Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.
Belanger Fan & Blower Co., Detroit, Mich.
Champion Blower & Forge Co., Lancaster, Pa.
Chelsea Fan & Blower Co., Irvington, N. J.
Circulators & Devices Mfg. Corp., New York, N. Y.
Dallas Engineering Co., Inc., Dallas, Tex.
DeBothezat Ventilating Equipment Div., American Machine & Metals, Inc., East Moline, Ill.
Dual Air Fan Co., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
General Aire Co., Philadelphia, Pa.
International Engrg., Inc., Dayton, O.
Lohman Co., Wm. J., Irvington, N. J.
Meier Electric & Machine Co., Indianapolis, Ind.
Myers Electric Co., Inc., Pittsburgh, Pa.
Norwin Co., Freeport, Ill.
Peerless of America, Inc., Chicago, Ill.
Peerless Electric Co., Warren, O.
Schwitzer-Cummins Co., Indianapolis, Ind.
South Bend Air Products Corp., South Bend, Ind.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Swift Mfg. Co., Detroit, Mich.
●Torrington Mfg. Co., Torrington, Conn.
Utility Fan Corp., Los Angeles, Cal.
Victor Electric Products, Inc., Cincinnati, O.

BLAST GATES

See Gates, Blast

BLAST HEATERS

See Surface, Heating

BLAST HEATING COILS

See Surface, Heating

BLINDS, VENETIAN

Athey Co., Chicago, Ill.
Bostwick-Goodell Co., Norwalk, O. (Shutter awnings)
Chain Tape Venetian Blind Co., Rockford, Ill.
Chicago Venetian Blind Co., Chicago, Ill.
Columbia Mills, Inc., Saginaw, Mich.
Higgin Products, Inc., Newport, Ky.
Hough Shade Corp., Janesville, Wis.
Kane Mfg. Corp., Kane, Pa.
Miller & Connell Co., Chicago, Ill.
Mitchell Moulding Co., Forest Park, Ill.
Patterson Shade Co., Indianapolis, Ind.
Russell Co., F. C., Cleveland, O.
Schatz Venetian Blinds, Los Angeles, Cal.
Snead, Herbert S., New York, N. Y.
Standard Products Co., Detroit, Mich.
Swedish Venetian Blind Co., New York, N. Y.
Warren Shade Co., Inc., Minneapolis, Minn.
Western Venetian Blind Co., New York, N. Y.
Yardley Screen & Weather Strip Co., Columbus, O.

BLOW PIPE FITTINGS

See Fittings, Blow Pipe

BLOWER FANS

See Fans, Centrifugal

BLOWER WHEELS

See Wheels, Blower

BLOWERS, HIGH PRESSURE

For Low Pressure Blower Fans, See Fans, Centrifugal

Allen Billmyre Corp., Mamaroneck, N. Y.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Blower Corp., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Beach-Russ Co., New York, N. Y.
●Buffalo Forge Co., Buffalo, N. Y.
Burdett Mfg. Co., Chicago, Ill.
Carling Turbine Blower Co., Worcester, Mass.
Champion Blower & Forge Co., Lancaster, Pa.
Circulators & Devices Mfg. Corp., New York, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Eclipse Fuel Engineering Co., Rockford, Ill.
Garden City Fan Co., Chicago, Ill.
Ingersoll-Rand Co., New York, N. Y.
Lammert & Mann Co., Chicago, Ill.
Muncie Gear Wks., Muncie, Ind.
●National Machine Works, Chicago, Ill.
North American Mfg. Co., Cleveland, O.
Roots-Connersville Blower Corp., Connersville, Ind.
Spencer Turbine Co., Hartford, Conn.
●Sturtevant Co., B. F., Boston, Mass.
Trimount Rotary Power Co., East Bedham, Mass.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.

BLOWERS, SOOT

Bayer Co., St. Louis, Mo.
Diamond Power Specialty Corp., Detroit, Mich.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Marion Machine Foundry & Supply Co., Marion, Ind.
Perfection Grate & Stoker Co., Springfield, Mass.
●Sturtevant Co., B. F., Boston, Mass.

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BLOW-OFF VALVES
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BLUE PRINT MACHINES
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BOILER CLEANING COMPOUNDS
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BOILER FEED PUMPS
See Pumps, Boiler Feed

BOILER FEEDERS
See Feeders, Water, Heating Boiler

BOILER OBSERVATION PORTS
See Ports, Observation, Boiler

BOILER SEALING COMPOUNDS
See Compounds, Boiler and Radiator Sealing

BOILER AND TANK INSULATION
See Insulation, Boiler and Tank

BOILER TUBES
See Tubes, Boiler

BOILER WATER ALARMS
See Alarms, High and Low Boiler Water

BOILERS, HEATING, CAST IRON, SECTIONAL
2000 Sq Ft Steam Radiation and Over

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Bryan Steam Corp., Peru, Ind.
●Bryant Heater Co., The, Cleveland, O.
●Burnham Boiler Corp., Irvington, N. Y.
Columbia Radiator Co., McKeesport, Pa.
Crane Co., Chicago, Ill.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Herbert Boiler Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Kohler Co., Kohler, Wis.
National Radiator Co., The, Johnstown, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Inc., Frank, Terre Haute, Ind.
Smith Co., Inc., H. B., The, Westfield, Mass.
Spencer Heater Div., Aviation Mfg. Corp., Williamsport, Pa.
Thatcher Furnace Co., Newark, N. J.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Weil-McLain Co., Chicago, Ill.

BOILERS, HEATING, STEEL, FIRE TUBE
2000 Sq Ft Steam Radiation and Over

Ames Iron Wks., Div. of Pierce Butler Radiator Corp., Oswego, N. Y.
Atlantic Steel Boiler Co., Philadelphia, Pa.
Bass Foundry & Machine Co., Ft. Wayne, Ind.
Bigelow Co., New Haven, Conn.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
●Burnham Boiler Corp., Irvington, N. Y.
Cleaver-Brooks Co., Milwaukee, Wis.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., New York, N. Y.
Dillon Steam Boiler Wks., Inc., D. M., Fitchburg, Mass.
Eclipse Fuel Engineering Co., Rockford, Ill.
Erie City Iron Wks., Erie, Pa.
Farrar & Trefts, Buffalo, N. Y.
●Fitzgibbons Boiler Co., Inc., New York, N. Y.
Frost Mfg. Co., Galesburg, Ill.
Gallaher Boiler Co., St. Louis, Mo.
General Furnaces Corp., New York, N. Y.
Hodge Boiler Wks., East Boston, Mass.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Inc., Framingham, Mass.
Johnston Bros., Inc., Ferrysburg, Mich.
Keeler Co., Williamsport, Pa.
●Kewanee Boiler Corp., Kewanee, Ill.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Leffel & Co., Springfield, O.
Lookout Boiler & Mfg. Co., Chattanooga, Tenn.
Manitowoc Boiler Wks., Manitowoc, Wis.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
Murray Iron Wks. Co., Burlington, Ia.
National Radiator Co., The, Johnstown, Pa.
Oil City Tank & Boiler Co., Oil City, Pa.
Orr & Sembower, Inc., Reading, Pa.
PS Inc., Los Angeles, Cal. (Flash type)
Pacific Steel Boiler Div., United States Radiator Corp., Detroit, Mich.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Smith Twin Tubular Boiler Co., Inc., Philadelphia, Pa.
Spencer Heater Div., Aviation Mfg. Corp., Williamsport, Pa.
Titusville Iron Wks. Co., Titusville, Pa.
Union Iron Wks., Erie, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Vortex Mfg. Co., Portland, Ore.
Wickes Boiler Co., Saginaw, Mich.

BOILERS, HEATING, STEEL, WATER TUBE

Anetsberger Bros., Chicago, Ill.
Atlantic Steel Boiler Co., Philadelphia, Pa.
Babcock & Wilcox Co., New York, N. Y.
Bass Foundry & Machine Co., Ft. Wayne, Ind.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Bryan Steam Corp., Peru, Ind.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., New York, N. Y.
Edge Moor Iron Wks., Inc., New York, N. Y.
Erie City Iron Wks., Erie, Pa.
Foster Wheeler Corp., New York, N. Y.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Inc., Framingham, Mass.
Keeler Co., E., Williamsport, Pa.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Murray Iron Wks. Co., Burlington, Ia.
Oil City Tank & Boiler Co., Oil City, Pa.
Orr & Sembower, Inc., Reading, Pa.
Riley Stoker Corp., Worcester, Mass.
Smith Twin Tubular Boiler Co., Inc., Philadelphia Pa.
Spencer Heater Div., Aviation Mfg. Corp., Williamsport, Pa.
Titusville Iron Wks. Co., Titusville, Pa.
Union Iron Works, Erie, Pa.
Vapor Car Heating Co., Inc., Chicago, Ill.
Vogt Machine Co., Henry, Louisville, Ky.
Waterfilm Boilers, Inc., Jersey City, N. J.
Wickes Boiler Co., Saginaw, Mich.

BOLTS, EXPANSION

Chicago Expansion Bolt Co., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Fee & Mason Mg. Co., Inc., New York, N. Y.
National Lead Co., New York, N. Y.
Ohio Brass Co., Mansfield, O.
Paine Co., Chicago, Ill.
Rawlplug Co., Inc., The, New York, N. Y.
Rolyan Corp., Chicago, Ill.
Star Expansion Bolt Co., New York, N. Y.
U. S. Expansion Bolt Co., York, Pa.

BOLTS AND STUDS, FLANGE

Bethlehem Steel Co., Bethlehem, Pa.
Clark Bros. Bolt Co., Milldale, Conn.
Crane Co., Chicago, Ill.
Erie Bolt & Nut Co., Erie, Pa.
Haskell Mfg. Co., Wm. H., Pawtucket, R. I.
Lamson & Sessions Co., Cleveland, O.
Maintenance Engineering Corp., Houston, Texas
Republic Steel Corp., Bolt & Nut Div., Cleveland, O.
Rolyan Corp., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOLTS, TOGGLE AND ANCHOR

Carty & Moore Engineering Co., Detroit, Mich.
Chicago Expansion Bolt Co., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
Grabler Mfg. Co., Cleveland, O.
Lamson & Sessions Co., Cleveland, O.
Paine Co., Chicago, Ill.
Rawlplug Co., Inc., The, New York, N. Y.
Republic Steel Corp., Cleveland, O.
Rolyan Corp., Chicago, Ill.
Star Expansion Bolt Co., New York, N. Y.
U. S. Expansion Bolt Co., York, Pa.

BOOTHS, PAINTING, SPRAY

Belanger Fan & Blower Co., Detroit, Mich.
●Binks Mfg. Co., Chicago, Ill.
●Day Co., The, Minneapolis, Minn.
DeVilbiss Co., The, Toledo, O.
Goethel Sheet Metal Works, Alfred, Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
●Industrial Sheet Metal Works, Inc., Detroit, Mich.
Kirk & Blum Mfg. Co., Cincinnati, O.
Mahon Co., R. C., Detroit, Mich.
Northern Blower Co., Cleveland, O.
Schmieg Sheet Metal Works, Detroit, Mich.
Spray Engineering Co., Somerville, Mass.
Young & Bertke Co., Cincinnati, O.

BRAKES, SHEET METAL, HAND

Dreis & Krump Mfg. Co., Chicago, Ill.
Eiker Mfg. Co., Ogallala, Nebr.
New Albany Machine Mfg. Co., New Albany, Ind.
Niagara Machine & Tool Works, Buffalo, N. Y.
●O'Neil-Irwin, Inc., Minneapolis, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Weiss & Co., H., New York, N. Y.
Whitney Metal Tool Co., Rockford, Ill.

BRAKES, SHEET METAL, PORTABLE

Dreis & Krump Mfg. Co., Chicago, Ill.
Eiker Mfg. Co., Ogallala, Nebr.
Harris, A. R., Hammond, Ind.
●O'Neil-Irwin, Inc., Minneapolis, Minn.
Whitney Metal Tool Co., Rockford, Ill.

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BRAKES, SHEET METAL, POWER

Cincinnati Shaper Co., Cincinnati, O.
Dreis & Krump Mfg. Co., Chicago, Ill.
Excelsior Tool and Machine Co., East St. Louis, Ill.
Heartley Machine & Tool Co., Toledo, O.
Ohl & Co., Geo. A., Newark, N. J.
Peck, Stow & Wilcox Co., Southington, Conn.
Rafter Machine Co., Belleville, N. J.
Swaine Mfg. Co., Fred J., St. Louis Mo.
Verson Allsteel Press Co., Chicago, Ill.
Weiss & Co., H., New York, N. Y.

BRASS PIPE

See Pipe, Brass and Copper

BRASS TUBING

See Tubing, Brass and Copper

BRASS UNIONS

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BRASS VALVES

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BRAZING TORCHES

See Torches, Brazing

BRONZE VALVES

See Valves, Gate; and Valves, Globe

BUILDING INSULATION

See Insulation, Building

BURNERS, GAS, COMMERCIAL AND INDUSTRIAL

Barber Gas Burner Co., Cleveland, O.
Beck Engineering Combustion Kompany, St. Louis, Mo.
●Bryant Heater Co., The, Cleveland, O.
Burdett Mfg. Co., Chicago, Ill.
Campbell Heating Co., E. K., Kansas City, Mo.
Continental Stove Corp., Ironton, O.
Coppus Engineering Corp., Worcester, Mass.
Eclipse Fuel Engrg. Co., Rockford, Ill.
Engineer Co., New York, N. Y.
Enterprise Engine & Foundry Co., San Francisco, Cal.
Hugo Mfg. Co., West Duluth, Minn.
Jamieson Mfg. Co., Dallas, Tex.
Johnson Gas Appliance Co., Cedar Rapids, Ia.
Lammert & Mann Co., Chicago, Ill.
Martin, J. O. & C. U., San Francisco, Cal.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Mettler Co., Lee B., Los Angeles, Cal.
National Airoil Burner Co., Inc., Philadelphia, Pa.
●National Machine Wks., Chicago, Ill.
North American Mfg. Co., Cleveland, O.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Peabody Engrg. Corp., New York, N. Y.
R-S Products Corp., Philadelphia, Pa.
Ray Oil Burner Co., San Francisco, Cal.
●Reznor Mfg. Co., Mercer, Pa.
Roberts-Gordon Appliance Corp., Buffalo, N. Y.
Rotary Mfg. Co., Los Angeles, Cal.
Schutte & Koerting Co., Philadelphia, Pa.
Selas Co., The, Philadelphia, Pa.
Sonner Burner Co., Winfield, Kans.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
●Surface Combustion Corp., Toledo, O.
Todd Combustion Equipment, Inc., New York, N. Y.
●Webster Engineering Co., Tulsa, Okla.
Williams, Inc., F. C., Dearborn, Mich.
●Zink Co., John, Tulsa, Okla.

BURNERS, GAS AND OIL COMBINED, COMMERCIAL AND INDUSTRIAL

Air Devices, Inc., New York, N. Y.
Babcock & Wilcox Co., New York, N. Y.
Coppus Engineering Corp., Worcester, Mass.
Engineer Co., New York, N. Y.
Enterprise Engine & Foundry Co., San Francisco, Cal.
Johnson Co., S. T., Oakland, Cal.
Mettler Co., Lee B., Los Angeles, Cal.
National Airoil Burner Co., Inc., Philadelphia, Pa.
Peabody Engineering Corp., New York, N. Y.
R-S Products Corp., Philadelphia, Pa.
Ray Oil Burner Co., San Francisco, Cal.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Todd Combustion Equipment, Inc., New York, N. Y.
●Webster Engineering Co., Tulsa, Okla.
●Zink Co., John, Tulsa, Okla.

BURNERS, OIL, COMMERCIAL AND INDUSTRIAL

Ace Engineering Co., Chicago, Ill.
Air Devices, Inc., New York, N. Y.
Babcock & Wilcox Co., New York, N. Y.
Bennett Co., Omaha, Nebr.
Bethlehem Foundry & Machine Co., Bethlehem, Pa.
Caloroil Burner Corp., Hartford, Conn.
Century Engrg. Corp., Cedar Rapids, Ia.
Chalmers Oil Burner Co., Minneapolis, Minn.
Chisholm Co., Allen E., Portland, Ore.
Combustion Engineering Co., Inc., New York, N. Y.
Eastern Oil & Equipment Co., Inc., Portland, Me.
Electrol, Inc., Clifton, N. J.
Engineering Co., New York, N. Y.
Enterprise Engine & Foundry Co., San Francisco, Cal.
Hardinge Mfg. & Oil Burner Co., Chicago, Ill.
Harvey-Whipple, Inc., Springfield, Mass.
Holtum Mfg. Co., Freeport, Ill.
Johnson Co., S. T., Oakland, Cal.
Johnson Mfg. Co., Waterloo, Ia.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Lammert & Mann Co., Chicago, Ill.
Littleford Bros., Cincinnati, O.
Mettler Co., Lee B., Los Angeles, Cal.
Micro-Westco, Inc., Bettendorf, Ia.
Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
Montag Stove & Furnace Works, Portland, Ore.
National Airoil Burner Co., Inc., Philadelpia, Pa.
North American Mfg. Co., Cleveland, O.
Nu-Way Corp., Rock Island, Ill.
Peabody Engrg. Corp., New York, N. Y.
●Petroleum Heat & Power Co., Stamford, Conn.
Preferred Utilities Mfg. Corp., New York, N. Y.
Quiet Heet Mfg. Co., Newark, N. J.
R-S Products Corp., Philadelphia, Pa.
Ray Oil Burner Co., San Francisco, Cal.
Reif-Rexoil, Inc., Buffalo, N. Y.
Riley Stoker Corp., Worcester, Mass.
Rotary Mfg. Co., Los Angeles, Cal.
Schutte & Koerting Co., Philadelphia, Pa.
Scott-Newcomb, Inc., St. Louis, Mo.
Simplex Oil Heating Corp., New York, N. Y.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Todd Combustion Equipment, Inc., Brooklyn, N. Y.
Vortex Mfg. Co., Portland, Ore.
Wayne Oil Burner Corp., Fort Wayne, Ind.
●Webster Engineering Co., Tulsa, Okla.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
Williams, Inc., F. C., Dearborn, Mich.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
York Oil Burner Co., Inc., York, Pa.
●Zink Co., John, Tulsa, Okla.

CARBON DIOXIDE ANALYZERS

See Analyzers, Carbon Dioxide, Portable

CARBON DIOXIDE INDICATORS

See Indicators, Carbon Dioxide, Boiler Room

CARBON PIPE, TUBING, FITTINGS AND VALVES

See Pipe, Tubing, Fittings and Valves, Carbon

CAST IRON PIPE

See Pipe, Cast Iron

CEMENT AND COMPOUNDS, PIPE JOINT

Acme Refining Co., The, Cleveland, O.
Acorn Refining Co., Cleveland, O.
Aeco Packing Products Co., Chicago, Ill.
Akron Metallic Gasket Co., Akron, O.
Atlas Chemical Co., Marietta, O.
Baer Bros., New York, N. Y.
Barber Asphalt Corp., Barber, N. J.
Black Magic Products Co., Tulsa, Okla.
Blue Seal Chemical Co., Roselle Park, N. J.
Burnley Battery & Mfg. Co., North East, Pa.
Calbar Paint & Varnish Co., Philadelphia, Pa.
Clinton Metallic Paint Co., Clinton, N. Y.
Colebrook & Sons, Inc., W. H., Syracuse, N. Y.
Continental Products Co., Euclid, O.
Cooper Sanitary Co., Philadelphia, Pa.
Crane Co., Chicago, Ill.
Crane Packing Co., Chicago, Ill.
Croll & Son, Jesse G., Philadelphia, Pa.
Dearborn Chemical Co., Chicago, Ill.
Detroit Graphite Co., Detroit, Mich.
Dixon Crucible Co., Joseph, Jersey City, N. J.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
●Grinnell Co., Inc., Providence, R. I.
Hercules Chemical Co., Inc., New York, N. Y.
Hetzel Roofing Products Co., Newark, N. J.
Horn Co., A. C., Long Island City, N. Y.
●Key Co., East St. Louis, Ill.
Krehbiel Co., J. H., Chicago, Ill.
Mackson's Co., New York, N. Y.
Metropolitan Refining Co., Inc., Long Island City, N. Y.
Montgomery Bros., San Francisco, Cal.
National Engineering Products, Inc., Washington, D. C.
Nebel Mfg. Co., Cleveland, O.
Permatex Co., Inc., Sheepshead Bay, N. Y.
Preferred Utilities Mfg. Corp., New York, N. Y.
Pyrolite Products Co., Cleveland, O.
Radiator Specialty Co., Charlotte, N. C.
Reilly Tar & Chemical Corp., Indianapolis, Ind.
Rockwood Sprinkler Co., Worcester, Mass.
Sauereisen Cements Co., Sharpsburg, Pa.
Schundler & Co., F. E., Long Island City, N. Y.
Smooth-On Mfg. Co., Jersey City, N. J.
Star Products Co., New York, N. Y.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Thompson & Co., Pittsburgh, Pa.
U. S. Stonewear Co., New York, N. Y.
Utility Laboratory, Inc., Brooklyn, N. Y.
Wilhelm Co., A., Reading, Pa.
X Laboratories, Inc., New York, N. Y.
X-Pando Corp., Long Island City, N. Y.

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CEMENT, FURNACE

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Armstrong Co., Detroit, Mich.
Buckeye Products Co., Cincinnati, O.
●Carey Mfg. Co., Philip, Lockland, Cincinnati, O.
Clinton Metallic Paint Co., Clinton, N. Y. (Asbestos)
Colebrook & Sons, Inc., W. H., Syracuse, N. Y.
Continental Products Co., Euclid, O.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Fireline Stove & Furnace Lining Co., Chicago, Ill.
Grant Wilson, Inc., Chicago, Ill. (Asbestos)
Green Fire Brick Co., A. P., Mexico, Mo.
Hercules Chemical Co., Inc., New York, N. Y.
Hetzel Roofing Products Co., Newark, N. J.
●Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y. (Asbestos)
Krehbiel Co., J. H., Chicago, Ill.
Laclede-Christy Clay Products Co., St. Louis, Mo.
Lastik Products Co., Inc., Pittsburgh, Pa.
McLeod & Henry Co., Inc., Troy, N. Y.
Munn and Steele, Inc., Newark, N. J.
Nebel Mfg. Co., Cleveland, O.
●Pecora Paint Co., Philadelphia, Pa.
Plastic Products Co., Detroit, Mich.
Preferred Utilities Mfg. Corp., New York, N. Y.
Presstite Engineering Co., St. Louis, Mo.
Pyrolite Products Co., Cleveland, O.
Refractory & Insulation Corp., New York, N. Y.
Rex Clay Products Co., Detroit, Mich.
Robinson Insulation Co., Great Falls, Mont.
Ruberoid Co., New York, N. Y.
●Rutland Fire Clay Co., Rutland, Vt.
Sall Mountain Co., Chicago, Ill.
Sauereisen Cements Co., Sharpsburg, Pa.
Standard Asbestos Mfg. Co., Chicago, Ill.
Standard Fuel Engineering Co., Detroit, Mich.
U. S. Stoneware Co., New York, N. Y.
Walsh Refractories Corp., St. Louis, Mo.
Wilhelm Co., A., Reading, Pa.
Wilson, Grant, Inc., Chicago, Ill. (Asbestos)

CEMENT, INSULATING

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
●Baldwin-Hill Co., Trenton, N. J. (Rock wool)
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Bird-Archer Co., Philadelphia, Pa.
Botfield Refractories Co., Philadelphia, Pa.
●Carey Mfg. Co., Philip, Lockland, Cincinnati, O.
Carney Rockwool Co., Mankato, Minn.
Chicago Fire Brick Co., Chicago, Ill.
Clinton Metallic Paint Co., Clinton, N. Y.
Colebrook & Sons, Inc., W. H., Syracuse, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
●Grant Wilson, Inc., Chicago, Ill.
Green Fire Brick Co., A. P., Mexico, Mo.
Industrial Research, Lansdowne, Pa.
International Vermiculite Co., Springfield, Ill.
●Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Krehbiel Co., J. H., Chicago, Ill. (Asbestos, mineral wool)
McLeod & Henry Co., Inc., Troy, N. Y.
Munn and Steele, Inc., Newark, N. J.
National Gypsum Co., Buffalo, N. Y.
Norristown Magnesia & Asbestos Co., Norristown, Pa.
Ohmlac Paint & Refining Co., Chicago, Ill
●Owens-Corning Fiberglas Corp., Toledo, O.
Preferred Utilities Mfg. Corp., New York, N. Y.
Pyrolite Products Co., Cleveland, O.
Ramtite Co., The, Chicago, Ill.
Refractory & Insulation Corp., New York, N. Y.
Rex Clay Products Co., Detroit, Mich.
Robinson Insulation Co., Great Falls, Mont.
Ruberoid Co., New York, N. Y.
●Rutland Fire Clay Co., Rutland, Vt.
Sall Mountain Co., Chicago, Ill.
Sauereisen Cements Co., Sharpsburg, Pa.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Smith & Kanzler Corp., Elizabeth, N. J.
Standard Asbestos Mfg. Co., Chicago, Ill.
Standard Fuel Engineering Co., Detroit, Mich.
Standard Lime & Stone Co., Baltimore, Md.
Tennessee Products Corp., Nashville, Tenn.
Therminsul Corp., Kalamazoo, Mich.
Thompson & Co., Pittsburgh, Pa.
United States Gypsum Co., Chicago, Ill.
United States Mineral Wool Co., Chicago, Ill.
Universal Zonolite Insulation Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Wilson, Inc., Grant, Chicago, Ill.

CENTRIFUGAL PUMPS

See Pumps, Centrifugal

CHAIN DRIVES

See Drives, Chain

CHANGERS, SPEED, HYDRAULIC COUPLING

American Blower Corp., Detroit, Mich.
Mercury Clutch Corp., Massillon, O.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CHANGERS, SPEED, MECHANICAL

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Briggs & Stratton Co., Milwaukee, Wis.
Browning Mfg. Co., Inc., Maysville, Ky.
Dodge Mfg. Corp., Mishawaka, Ind.
Jeffrey Mfg. Co., Columbus, O.
Lewellen Mfg. Co., Columbus, Ind.
Link-Belt Co., Philadelphia, Pa.
Moore Steam Turbine Div., Worthington Pump & Machinery Corp., Wellsville, N. Y.
Reeves Pulley Co., Columbus, Ind.
Speedmaster Co., The, Des Plaines, Ill.
Standard Transmission Equipment Co., Los Angeles, Cal.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
White Mfg. Co., St. Paul, Minn.

CHECK VALVES

See Valves, Check

CHILLERS, WATER, FOR AIR CONDITIONING AND REFRIGERATION

Acme Industries, Inc., Jackson, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
●Bell & Gossett Co., Morton Grove, Ill.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
●Downingtown Iron Works, Downingtown, Pa.
Drayer & Hanson, Inc., Los Angeles, Cal.
Filtrine Mfg. Co., Brooklyn, N. Y.
●Frick Co., Waynesboro, Pa.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
Griscom-Russell Co., The, New York, N. Y.
Heat Transfer Products, Inc., New York, N. Y.
Howe Ice Machine Co., Chicago, Ill.
●McQuay, Inc., Minneapolis, Minn.
Mojonnier Bros. Co., Chicago, Ill.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Refrigeration Economics Co., Inc., Canton, O.
Richmond Engineering Co., Inc., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Temprite Products Corp., Detroit, Mich.
●Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
●Whitlock Mfg. Co., Hartford, Conn.
XL Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

CIRCULATORS FOR HOT WATER HEATING SYSTEMS

American-Marsh Pumps, Inc., Battle Creek, Mich.
●Bell & Gossett Co., Morton Grove, Ill.
Columbus Steam Pump Works Co., Columbus, O.
Economy Pumps, Inc., Hamilton, O.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
General Blower Co., Inc., Philadelphia, Pa.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
Hotstream Heater Co., Cleveland, O.
Kehm Corp., The, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Mojonnier Brothers Co., Chicago, Ill.
Penberthy Injector Co., Detroit, Mich.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
●Trane Co., La Crosse, Wis.
Triplex Heating Specialty Co., Peru, Ind.
Watts Regulator Co., Lawrence, Mass.
White Flo-Matic Corp., Hoosick Falls, N. Y.

CLAMPS, BEAM, PIPE HANGING

Carpenter & Paterson, Inc., East Boston, Mass.
Chicago Nipple Mfg. Co., Chicago, Ill.
Crane Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Farley Sleeve & Hanger Co., Cleveland, O.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
●Frick Co., Waynesboro, Pa.
Globe Machine & Stamping Co., Cleveland, O.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Jarecki Mfg. Co., Erie, Pa.
National Valve & Mfg. Co., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
Walworth Co., New York, N. Y.

CLAMPS, PIPE REPAIR

Alten's Foundry & Machine Works, Lancaster, O.
Chelsea Metal Stamping Co., New York, N. Y.
Dresser Mfg. Co., Bradford, Pa.
Inner-Tite Clamp Corp., Elizabeth, N. J.

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Jarecki Mfg. Co., Erie, Pa.
Skinner Co., M. B., South Bend, Ind.
Smooth-On Mfg. Co., Jersey City, N. J.
●Yarnall-Waring Co., Philadelphia, Pa.

CLAMPS, PIPE, WELDING

●Detroit Stamping Co., Detroit, Mich.
●Jewel Mfg. Co., St. Paul, Minn.

CLEANERS, AIR, ELECTRICAL

●American Air Filter Co., Inc., Louisville, Ky.
●Westinghouse Electric & Mfg. Co., Cleveland, O.

CLEANERS, TUBE

Albright Equipment Co., Pittsburgh, Pa.
Armstrong Mfg. Co., Bridgeport, Conn.
Elliott Co., Jeannette, Pa.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Mall Tool Co., Chicago, Ill.
Perfection Grate & Stoker Co., Springfield, Mass.
Pierce Co., Wm. B., The, Buffalo, N. Y.
Pilley Brush Co., Fort Madison, Ia.
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Spencer Turbine Co., Hartford, Conn.

CLEANING COMPOUNDS

See Compounds, Cleaning, Pipe Coil and Condenser

COATINGS, PROTECTIVE, FOR METALS

●American Solder & Flux Co., Philadelphia, Pa. (galvanizing powder)
Dearborn Chemical Co., Chicago, Ill. (rust preventive)
Debevoise Co., The, Brooklyn, N. Y. (cement)
Eagle-Picher Lead Co., Cincinnati, O. (rust inhibitive)
Haering Co., Inc., D. W., Chicago, Ill. (drying and non-drying)
Laclede-Christy Clay Products Co., St. Louis, Mo. (high temperature paint)
Ohmlac Paint & Refining Co., Chicago, Ill. (acid resistant, heat resistant)
Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Pyrolite Products Co., Cleveland, O.
Reilly Tar & Chemical Corp., Indianapolis, Ind, (coal tar base)
U. S. Stoneware Co., New York, N. Y. (corrosion resistant)
Wailes Dove-Hermiston Corp., Westfield, N. J. (coal tar industrial pigmented)
White & Co., Haydn F., Cleveland, O.
Wipe-On Corp., New York, N. Y.

COCKS, BOILER GAGE

American Injector Co., Detroit, Mich.
Crane Co., Chicago, Ill.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

COILS

See Surface, Cooling; Surface, Heating

COILS, FOR HOT WATER STORAGE TANKS

●Bell & Gossett Co., Morton Grove, Ill.
Taco Heaters, Inc., New York, N. Y.

COILS, PIPE

●Baker Ice Machine Co., Inc., Omaha, Nebr.
Crane Co., Chicago, Ill.
●Downingtown Iron Works, Downingtown, Pa.
●Frick Co., Waynesboro, Pa.
●Marlo Coil Co., St. Louis, Mo.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Pipe Bending Co., New Haven, Conn.
Ohio Pipe Bending & Machine Co., Cleveland, O.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Semet-Solvay Engineering Corp., New York, N. Y.
●Vilter Mfg. Co., Milwaukee, Wis.
Vogt Machine Co., Henry, Louisville, Ky.

COLLECTORS, DUST

Allen Billmyre Corp., Mamaroneck, N. Y.
Allington & Curtis Mfg. Co., Saginaw, Mich.
●American Air Filter Co., Louisville, Ky.
American Blower Corp., Detroit, Mich.
American Foundry Equipment Co., Mishawaka, Ind.
Bayley Blower Co., Milwaukee, Wis.
Blower Application Co., Milwaukee, Wis.
Bubar, Hudson H., New York, N. Y.
●Buffalo Forge Co., Buffalo, N. Y.
Clark Dust Control Co., Chicago, Ill.
●Day Co., The, Minneapolis, Minn.
Dracco Corp., Cleveland, O.
Faraday Engineering Co., Boston, Mass.
Garden City Fan Co., Chicago, Ill.
Goethel Co., Alfred C., Milwaukee, Wis.
Goethel Sheet Metal Wks., Alfred, Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
●Industrial Sheet Metal Wks., Inc., Detroit, Mich.
Jacobs Co., B. & J., Cincinnati, O.
Kirk & Blum Mfg. Co., Cincinnati, O.
Kluegel & Co., E., St. Paul, Minn.
Knickerbocker Co., Jackson, Mich.
Martin Metal Mfg. Co., Wichita, Kan.
New York Blower Co., Chicago, Ill.
Northern Blower Co., Cleveland, O.
Pangborn Corp., Hagerstown, Md.
Prat-Daniel Corp., Port Chester, N. Y.
Puhl & Hepper Mfg. Co., Inc., St. Louis, Mo.
Research Corp., New York, N. Y.
Ruemelin Mfg. Co., Milwaukee, Wis.
Schneible Co., Claude B., Chicago, Ill.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Sly Mfg. Co., W. W., Cleveland, O.
Spencer Turbine Co., Hartford, Conn.
Steamaire Co., Cincinnati, O.
Steinhorst & Sons, Inc., Emil, Utica, N. Y.
Strandwitz & Co., Inc., W. J., Camden, N. J.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Torit Mfg. Co., St. Paul, Minn.
Western Blower Co., Seattle, Wash.
Western Precipitation Corp., Los Angeles, Cal.
Young & Bertke Co., Cincinnati, O.

COLLECTORS, WELDING FUME

Faraday Engineering Co., Boston, Mass.
Lincoln Electric Co., Cleveland, O.
Ruemelin Mfg. Co., Milwaukee, Wis.

COMBUSTION CONTROL

See Controls, Draft, Barometric; Regulators, Draft, Combustion; Systems, Combustion Control

COMBUSTION RECORDERS

See Recorders, Carbon Dioxide

COMPOUNDS, BOILER CLEANING

Acme Refining Co., The, Cleveland, O.
American K. A. T. Corp., New York, N. Y.
American Teksag Products, Inc., Mount Vernon, N. Y.
Aquatic Chemical Laboratories, Inc., New York, N. Y.
Blue Seal Chemical Co., Roselle Park, N. J.
Brown-Ford Corp., Newton, Mass.
Cannon Chemical Co., Everett, Mass.
Chicago Specialty Mfg. Co., Chicago, Ill.
Continental Products Co., Euclid, O.
Dearborn Chemical Co., Chicago, Ill.
Diamond Chemical Products, New York, N. Y.
Dissolene Corp., Hempstead, N. Y.
Ferro-Nil Corp., New York, N. Y.
Grief, Edward C., Bogota, N. J.
Hagan Corp., Pittsburgh, Pa.
Haering & Co., Inc., D. W., Chicago, Ill.
Hercules Chemical Co., Inc., New York, N. Y.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Krehbiel Co., J. H., Chicago, Ill.
Metropolitan Refining Co., Inc., Long Island City, N. Y.
National Aluminate Corp., Chicago, Ill.
North American Fibre Products Co., The, Cleveland, O.
Radiator Specialty Co., Charlotte, N. C.
Star Products Co., New York, N. Y.
Utility Laboratory, Inc., Brooklyn, N. Y.
Vinco Co., Inc., The, New York, N. Y.
Western Chemical Co., Kansas City, Mo.
X Laboratories, Inc., New York, N. Y.

COMPOUNDS, BOILER AND RADIATOR SEALING

Atlas Chemical Co., Marietta, O.
Blue Seal Chemical Co., Roselle Park, N. J.
Cannon Chemical Co., Everett, Mass.
Chicago Specialty Mfg. Co., Chicago, Ill.
Cooper Sanitary Co., Philadelphia, Pa.
Dearborn Chemical Co., Chicago, Ill.
Desolvo Co., The, Pittsburgh, Pa.
Dole Valve Co., The, Chicago, Ill.
Halowax Corp., New York, N. Y.
Hampton-Cross Co., The, Louisville, Ky.
Hercules Chemical Co., Inc., New York, N. Y.
Krehbiel Co., J. H., Chicago, Ill.
Metropolitan Refining Co., Inc., Long Island City, N. Y.
National Engineering Products, Inc., Washington, D. C.
Permatex Co., Inc., Sheepshead Bay, N. Y.
Radiator Specialty Co., Charlotte, N. C.
Star Products Co., New York, N. Y.
Vinco Co., Inc., The, New York, N. Y.
X Laboratories, Inc., New York, N. Y.

COMPOUNDS, CAULKING

Accurate Metal Weather Strip Co., New York, N. Y.
Acme Refining Co., The, Cleveland, O.
All Metal Weatherstrip Co., Chicago, Ill.
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
American Barlock Co., Inc., Long Island City, N. Y.
American Metal Weather Strip Co., Grand Rapids, Mich.
Armstrong Co., The, Detroit, Mich.
Asphalt Products Co., Syracuse, N. Y.
Barber Asphalt Corp., Barber, N. J.
Barland Weatherstrip Material Co., Cleveland, O.
Calbar Paint & Varnish Co., Philadelphia, Pa.
●Carey Mfg. Co., Philip, Cincinnati, O.
Chamberlin Metal Weather Strip Co., Detroit, Mich.
Clinton Metallic Paint Co., Clinton, N. Y.
Continental Products Co., Euclid, O.
Diamond Metal Weather Strip Co., Columbus, O.

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Eagle-Picher Lead Co., Cincinnati, O.
Flintkote Co., New York, N. Y.
Ford Roofing Products Co., Chicago, Ill.
Hetzel Roofing Products Co., Newark, N. J.
Horn Co., A. C., Long Island City, N. Y.
Iowa Paint Mfg. Co., Des Moines, Ia.
●Johns-Manville, New York, N. Y.
Klee Co., Geo. B., Cincinnati, O.
Krehbiel Co., J. H., Chicago, Ill.
Lastik Products Co., Inc., Pittsburgh, Pa.
Lehon Co., Chicago, Ill.
Maas & Waldstein Co., Newark, N. J.
Metropolitan Refining Co., Inc., Long Island City, N. Y.
National Mfg. Corp., Tonawanda, N. Y.
Nebel Mfg. Co., Cleveland, O.
North American Fibre Products Co., The, Cleveland, O.
Ohmlac Paint & Refining Co., Chicago, Ill.
●Pecora Paint Co., Philadelphia, Pa.
Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Plastic Products Co., Detroit, Mich.
Presstite Engineering Co., St. Louis, Mo.
Pyrolite Products Co., Cleveland, O.
Quigley Co., Inc., New York, N. Y.
Radiator Specialty Co., Charlotte, N. C.
Reilly Tar & Chemical Corp., Indianapolis, Ind.
Robertson Co., H. H., Pittsburgh Pa.
Sipe & Co., James B., Pittsburgh, Pa.
Smooth-On Mfg. Co., Jersey City, N. J.
Thompson & Co., Pittsburgh, Pa.
Tropical Paint & Oil Co., Cleveland, O.
U. S. Stoneware Co., New York, N. Y.
Wilhelm Co., A., Reading, Pa.
X-Pando Corp., Long Island City, N. Y.
Yardley Screen & Weather Strip Corp., Columbus, O.

COMPOUNDS, CLEANING, PIPE COIL AND CONDENSER

Aquatic Chemical Laboratories, Inc., New York, N. Y.
Blue Seal Chemical Co., Roselle Park, N. J.
Cannon Chemical Co., Everett, Mass.
Dearborn Chemical Co., Chicago, Ill.
Forslund Pump & Machinery Co., Kansas City, Mo.
Fuelmiser Co., Inc., Minneapolis, Minn.
Haering Co., Inc., D. W., Chicago, Ill.
Hercules Chemical Co., Inc., New York, N. Y.
North American Fibre Products Co., The, Cleveland, O.
Radiator Specialty Co., Charlotte, N. C.
Utility Laboratory, Inc., Brooklyn, N. Y.
Western Chemical Co., Kansas City, Mo.

COMPRESSOR BASES

See Bases and Pads, Vibration Isolating

COMPRESSORS, AIR

Allen Billmyre Corp., Mamaroneck, N. Y.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Beach-Russ Co., New York, N. Y.
●Binks Mfg. Co., Chicago, Ill.
Brunner Mfg. Co., Utica, N. Y.
Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Davey Compressor Co., Kent, O.
Dayton Air Compressor Co., Dayton, O.
DeVilbiss Co., The, Toledo, O.
Fuller Co., Catasauqua, Pa.
Gardner-Denver Co., Quincy, Ill.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hobart Bros., Troy, O.
Ingersoll-Rand, New York, N. Y.
Lammert & Mann Co., Chicago, Ill.
●Nash Engineering Co., South Norwalk, Conn.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Plummer Spray Equipment Co., Napoleon, O.
Schramm, Inc., West Chester, Pa.
Spencer Turbine Co., Hartford, Conn.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Trimount Rotary Power Co., East Dedham, Mass.
Uniflow Mfg. Co., Erie, Pa.
Union Steam Pump Co., Battle Creek, Mich.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

COMPRESSORS, REFRIGERATING, CENTRIFUGAL

●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y. (Carrene)
Coroaire Heater Corp., The, Cleveland, O.
DeLaval Steam Turbine Co., Trenton, N. J. (Water vapor).
Ingersoll-Rand, New York, N. Y. (Water vapor).
●Trane Co., LaCrosse, Wis.
●York Ice Machinery Corp., York, Pa.

COMPRESSORS, REFRIGERATING, RECIPROCATING

Airtemp, Div. of Chrysler Corp., Dayton, O. (Radial).
●Baker Ice Machine Co., Inc., Omaha, Nebr. ("Freon," Methyl chloride, Ammonia).
Brunner Mfg. Co., Utica, N. Y. (Methyl chloride, "Freon," sulphur dioxide).
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y. ("Freon")
Copeland Refrigeration Corp., Sidney, O.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
De La Vergne Engine Co., Philadelphia, Pa. (Ammonia, "Freon").
Diceler Corp., The, Greenville, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa. (Ammonia, carbon dioxide, methyl chloride, "Freon").
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
Gale Products, Galesburg, Ill.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Machinery Co., Spokane, Wash.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Howe Ice Machine Co., Chicago, Ill. ("Freon," ammonia, methyl chloride).
Ingersoll-Rand, New York, N. Y.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Merchant & Evans Co., Philadelphia, Pa. ("Freon," methyl chloride, sulphur dioxide).
Mills Novelty Co., Chicago, Ill.
Modern Equipment Corp., Defiance, O.
Nash Refrigeration Co., Inc., Newark, N. J.
Phoenix Ice Machine Co., Cleveland, O.
Reliance Refrigerating Machine Co., Chicago, Ill. ("Freon," methyl chloride, ammonia).
Reynolds Mfg. Co., Inc., Springfield, Mo.
Servel, Inc., Electric Refrigeration & Air Conditioning Div., Evansville, Ind. ("Freon," methyl chloride).
Standard Computing Scale Co., The, Air Conditioning and Refrigeration Div., Detroit, Mich.
Starr Piano Co., Richmond, Ind.
Stewart Ice Machine Co., Los Angeles, Cal.
Tecumseh Products Co., Tecumseh, Mich.
●Trane Co., La Crosse, Wis.
Universal Cooler Corp., Marion, O. (Methyl chloride, "Freon").
●Vilter Mfg. Co., Milwaukee, Wis. ("Freon," ammonia).
Westinghouse Electric & Mfg. Co., Springfield, Mass.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill. ("Freon," methyl chloride).
Wittenmeier Machinery Co., Chicago, Ill. (Carbon dioxide).
XL Refrigerating Co., Chicago, Ill. (Ammonia, methyl chloride).
●York Ice Machinery Corp., York, Pa. (Carbon dioxide, ammonia, "Freon").

COMPRESSORS, REFRIGERATING, STEAM JET

●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y.
Croll-Reynolds Engrg. Co., Inc., New York, N. Y.
Elliott Co., Jeannette, Pa.
Foster Wheeler Corp., New York, N. Y.
Ingersoll-Rand, New York, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.

COMPRESSORS, STEAM BOOSTER

Foster Wheeler Corp., New York, N. Y.
Ingersoll-Rand, New York, N. Y.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

CONDENSATION METERS

See Meters, Condensation

CONDENSATION PUMPS

See Pumps, Condensation

CONDENSERS, REFRIGERATING, EVAPORATIVE

Acme Industries, Inc., Jackson, Mich.
American Cooling Tower Co., Kansas City, Mo.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Baltimore Air Coil Co., Baltimore, Md.
●Buffalo Forge Co., Buffalo, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Faraday Engineering Co., Boston, Mass.
●Frick Co., Waynesboro, Pa.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●G & O Mfg. Co., New Haven, Conn.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Harry Cooling Towers, Inc., New York, N. Y.
Hess Warming & Ventilating Co., Chicago, Ill.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Larkin Coils, Inc., Atlanta, Ga.

● Advertisement in this issue. See Index to Advertisers, page 326.

Long Mfg., Div. Borg-Warner Corp., Detroit, Mich.
●Marlo Coil Co., St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.
●New England Cooling Tower Co., Boston, Mass.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Richmond Engrg. Co., Inc., Richmond, Va.
●Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
XL Refrigerating Co., Chicago, Ill.
Yates-American Machine Co., Beloit, Wis.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

CONDENSERS, REFRIGERATING, SHELL AND TUBE

Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
●Bell & Gossett Co., Morton Grove, Ill.
Biggs Boiler Works Co., E. Akron, O.
●Bush Mfg. Co., Hartford, Conn.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y. (Carrene).
●Curtis Refrigerating Machine Co., St. Louis, Mo.
De La Vergne Engine Co., Philadelphia, Pa.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
●Downingtown Iron Works, Downingtown, Pa.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Frick Co., Waynesboro, Pa.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●G. & O. Mfg. Co., New Haven, Conn.
●General Electric Co., Air Conditioning & Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Heat Transfer Products, Inc., New York, N. Y.
Howe Ice Machine Co., Chicago, Ill.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Kramer Trenton Co., Trenton, N. J.
●Murray Mfg. Co., D. J., Wausau, Wis.
Nash Refrigeration Co., Inc., Newark, N. J.
Ohio Pipe Bending & Machine Co., Cleveland, O.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Refrigeration Economics Co., Inc., Canton, O.
Reliance Refrigerating Machine Co., Chicago, Ill.
Reynolds Mfg. Co., Inc., Springfield, Mo.
Richmond Engrg. Co., Inc., Richmond, Va.
Roessing Mfg. Co., Pittsburgh, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Servel, Inc., Electric Refrigeration & Air Conditioning Div., Evansville, Ind.
Stewart Ice Machine Co., Los Angeles, Cal.
Struthers-Wells-Titusville Co., Titusville, Pa.
Union Steam Pump Co., Battle Creek, Mich.
●Vilter Mfg. Co., Milwaukee, Wis.
Vogt Machine Co., Henry, Louisville, Ky.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Whitlock Mfg. Co., Hartford, Conn.
Wittenmeier Machinery Co., Chicago, Ill.
XL Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.
Zallea Brothers & Johnson, Wilmington, Del.

CONDENSING UNITS

See Compressors

CONDUIT, UNDERGROUND PIPING

●American District Steam Co., North Tonawanda, N. Y.
Dockstader, S. E., Washington, D. C.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
●Johns-Manville, New York, N. Y.
Michigan Pipe Co., Bay City, Mich.
●Porter & Co., Inc., H. W., Newark, N. J.
●Ric-wiL Co., Cleveland, O.
Underground Steam Construction Co., Boston, Mass.
Wyckoff & Son Co., A., Elmira, N. Y.

CONNECTIONS, DUCT, FLEXIBLE (ASBESTOS, CANVAS, ETC.)

Canvas Products Co., St. Louis, Mo.
Carpenter & Co., Geo. B., Chicago, Ill.
Felters Co., Inc., Boston, Mass.
●Wilson, Inc., Grant, Chicago, Ill. (Asbestos).

CONTROL, FOR INDIRECT WATER HEATERS

●Bell & Gossett Co., Morton Grove, Ill.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
●Trane Co., La Crosse, Wis.

CONTROLLERS AND STARTERS, MOTOR

●Allen-Bradley Co., Milwaukee, Wis.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Bender Warrick Corp., Birmingham, Mich.
Clark Controller Co., Cleveland, O.
Cutler-Hammer, Inc., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.
Electric Machinery Co., Minneapolis, Minn. (Synchronous motor).
●General Electric Co., Schenectady, N. Y.
Hart Mfg. Co., Hartford, Conn.
Monitor Controller Co., The, Baltimore, Md.
Ohio Brass Co., Mansfield, O.
Penn Electric Switch Co., Goshen, Ind.
Reynolds Electric Co., Chicago, Ill.
Square D Co., Milwaukee, Wis.
Trumbull Electric Mfg. Co., Plainville, Conn.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Zenith Electric Co., Chicago, Ill.

CONTROLS, DOOR, ELECTRIC EYE (FOR AIR CONDITIONED ROOMS)

Yale & Towne Mfg. Co., Stamford, Conn.

CONTROLS, DRAFT, BAROMETRIC

Field Control Div., H. D. Conkey & Co., Mendota, Ill.
Preferred Utilities Mfg. Corp., New York, N. Y.
●Simplex Mfg. Co., Fond du Lac, Wis.

CONTROLS, SPRINKLER SYSTEM

●Barber-Colman Co., Rockford, Ill.
●Grinnell Co., Inc., Providence, R. I.
Rockwood Sprinkler Co., Worcester, Mass.
Square D Co., Detroit, Mich.

CONVECTORS

See Radiation, Convection Ty

COOLERS, OIL

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Andale Co., Philadelphia, Pa.
American Locomotive Co., Alco Products Div., New York, N. Y.
●Bell & Gossett Co., Morton Grove, Ill.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Davis Engineering Corp., Elizabeth, N. J.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Elliott Co., Jeannette, Pa.
Foster Wheeler Corp., New York, N. Y.
●G & O Mfg. Co., New Haven, Conn.
●General Electric Co., Schenectady, N. Y.
Griscom-Russell Co., The, New York, N. Y.
Kramer Trenton Co., Trenton, N. J.
Modine Mfg. Co., Racine, Wis.
National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
●Shaw-Perkins Mfg. Co., Pittsburgh, Pa.
Sims Co., Erie, Pa.
●Trane Co., La Crosse, Wis.
Vogt Machine Co., Henry, Louisville, Ky.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Whitlock Mfg. Co., Hartford, Conn.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.
Zallea Brothers & Johnson, Wilmington, Del.

COOLERS, UNIT (FLOOR TYPE)

Not air conditioning units, but floor mounted unit with coil and centrifugal fans without filters, for connection to remote compressor or cold water supply. For air conditioning units see Units, Air Conditioning

Acme Industries, Inc., Jackson, Mich.
American Blower Corp., Detroit, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Beacon-Morris Corp., Boston, Mass. (Custom built)
●Buffalo Forge Co., Buffalo, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
Coolmaster Corp., Chicago, Ill. (Evaporative cooling principle, no dehumidifying)
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Economy Equipment Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Hastings Air Conditioning Co., Hastings, Neb.
Howe Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.

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- Kramer Trenton Co., Trenton, N. J.
- ●Marlo Coil Co., St. Louis, Mo.
- ●McQuay, Inc., Minneapolis, Minn.
- ●Murray Mfg. Co., D. J., Wausau, Wis.
- Peerless of America, Inc., Chicago, Ill.
- Refrigeration Appliances, Inc., Chicago, Ill.
- Refrigeration Economics Co., Inc., Canton, O.
- Rempe Co., Chicago, Ill.
- Richmond Engineering Co., Inc., Richmond, Va.
- Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
- ●Trane Co., LaCrosse, Wis.
- ●U. S. Air Conditioning Corp., Minneapolis, Minn.
- ●Vilter Mfg. Co., Milwaukee, Wis.
- X L Refrigerating Co., Chicago, Ill.
- ●York Ice Machinery Corp., York, Pa.
- ●Young Radiator Co., Racine, Wis.

COOLERS, UNIT (SUSPENDED TYPE)

Not air conditioning units, but suspended unit with coil and propellor fan without filters, for connection to remote compressor or cold water supply. For air conditioning units, see Units, Air Conditioning

- Acme Industries, Inc., Jackson, Mich.
- American Blower Corp., Detroit, Mich.
- American Coils, Inc., Newark, N. J.
- ●Baker Ice Machine Co., Inc., Omaha, Nebr.
- Beacon-Morris Corp., Boston, Mass. (Custom built)
- Berns Specialty Co., Chicago, Ill.
- ●Buffalo Forge Co., Buffalo, N. Y.
- ●Bush Mfg. Co., Hartford, Conn.
- ●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
- Carrier Corp., Syracuse, N. Y.
- ●Clarage Fan Co., Kalamazoo, Mich.
- Conditionaire Unit Co., Chicago, Ill.
- Coolmaster Corp., Chicago, Ill. (Evaporative cooling principle, no dehumidifying)
- ●Curtis Refrigerating Machine Co., St. Louis, Mo.
- Drayer & Hanson, Inc., Los Angeles, Cal.
- ●Fedders Mfg. Co., Inc., Buffalo, N. Y.
- ●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
- General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
- Hastings Air Conditioning Co., Hastings, Neb.
- Howe Ice Machine Co., Chicago, Ill.
- ●Ilg Electric Ventilating Co., Chicago, Ill.
- Johnson Fan & Blower Corp., Chicago, Ill.
- Kauffman Air Conditioning Corp., St. Louis, Mo.
- Kennard, Inc., Sam, St. Louis, Mo.
- King Ventilating Co., Owatonna, Minn.
- Kramer Trenton Co., Trenton, N. J.
- Larkin Coils, Inc., Atlanta, Ga.
- ●Marlo Coil Co., St. Louis, Mo.
- ●McCord Radiator & Mfg. Co., Detroit, Mich.
- ●McQuay, Inc., Minneapolis, Minn.
- Merchant & Evans Co., Philadelphia, Pa.
- ●Murray Mfg. Co., D. J., Wausau, Wis.
- Peerless of America, Inc., Chicago, Ill.
- Refrigeration Appliances, Inc., Chicago, Ill.
- Refrigeration Economics Co., Inc., Canton, O.
- Rempe Co., Chicago, Ill.
- Richmond Engrg. Co., Inc., Richmond, Va.
- Simmons Co., Gordon H., Milwaukee, Wis.
- Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
- Super Radiator Corp., Minneapolis, Minn.
- Tenney Engineering, Inc., Bloomfield, N. J.
- Thermal Co., Inc., Milwaukee, Wis.
- ●Trane Co., LaCrosse, Wis.
- ●U. S. Air Conditioning Corp., Minneapolis, Minn.
- ●Vilter Mfg. Co., Milwaukee, Wis.
- ●Wing Mfg. Co., L. J., New York, N. Y.
- X L Refrigerating Co., Chicago, Ill.
- ●York Ice Machinery Corp., York, Pa.
- ●Young Radiator Co., Racine, Wis.

COOLING COILS

See Surface, Cooling

COOLING SURFACE

See Surface, Cooling

COOLING TOWERS

See Towers, Cooling

COOLING UNITS

See Units, Air Conditioning; Coolers, Unit

COPPER PIPE

See Pipe, Brass and Copper

COPPER SHEETS

See Sheets, Copper

COPPER TUBE FITTINGS

See Fittings, Copper Tube

COPPER TUBING

See Tubing, Brass and Copper

COUNTERS, DUST

- Bausch & Lomb Optical Co., Rochester, N. Y.
- Service to Industry, West Hartford, Conn.
- Willson Products, Inc., Reading, Pa.

COUPLINGS, FLEXIBLE, POWER TRANSMISSION

- Ajax Flexible Coupling Co., Westfield, N. Y.
- ●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- American Flexible Coupling Co., Erie, Pa.
- Blood Brothers, Allegan, Mich. (Universal joints)
- Boston Gear Wks., Inc., North Quincy, Mass.
- Caldwell Co., W. E., Louisville, Ky.
- Certified Flexible Couplings, Inc., New York, N. Y.
- Chain Belt Co., Milwaukee, Wis.
- Chicago Die Casting Mfg. Co., Chicago, Ill.
- Congress Die Casting Div., Congress Tool & Die Co., Detroit, Mich.
- Continental Diamond Fibre Co., Newark, Del.
- Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.
- De Laval Steam Turbine Co., Trenton, N. J.
- Diamond Chain & Mfg. Co., Indianapolis, Ind.
- Dodge Mfg. Corp., Mishawaka, Ind.
- Flexo Supply Co., Inc., St. Louis, Mo.
- Guardian Utilities Co., Michigan City, Ind.
- Jeffrey Mfg. Co., Columbus, O.
- Jones Foundry & Machine Co., W. A., Chicago, Ill.
- Koppers Co., Bartlett Hayward Div., Baltimore, Md.
- Lewis & Co., Inc., Chas. S., St. Louis, Mo.
- Link-Belt Co., Indianapolis, Ind.
- Lord Mfg. Co., Erie, Pa.
- Lovejoy Flexible Coupling Co., Chicago, Ill.
- Medart Co., St. Louis, Mo.
- Mercury Clutch Corp., Massillon, O.
- Moran Flexible Steam Joint Co., Louisville, Ky.
- Morse Chain Co., Ithaca, N. Y.
- Poole Foundry & Machine Co., Baltimore, Md.
- Shallcross Co., Philadelphia, Pa.
- Smith, Inc., Winfield H., Springville, N. Y.
- Waldron Corp., John, New Brunswick, N. J.
- Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
- Whitney Chain & Mfg. Co., The, Hartford, Conn.
- Wood's Sons Co., T. B., Chambersburg, Pa.

COUPLINGS, PIPE

- Alabama Pipe Co., Anniston, Ala. (Cast iron).
- ●Byers Co., A. M., Pittsburgh, Pa.
- Champion Machine & Forging Co., Cleveland, O.
- Clow & Sons, James B., Chicago, Ill.
- Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
- Crane Co., Chicago, Ill.
- Detroit Brass & Malleable Works, Detroit, Mich.
- Dillon Co., Tulsa, Okla.
- Dresser Mfg. Co., Bradford, Pa.
- Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
- Grabler Mfg. Co., Cleveland, O.
- ●Grinnell Co., Inc., Providence, R. I.
- H. & B. Sales Co., Ltd., Long Beach, Cal. (Swing joint)
- Hanlon-Waters, Inc., Tulsa, Okla.
- Harrisburg Steel Corp., Harrisburg, Pa.
- Hasco Valve & Machine Co., Milwaukee, Wis.
- Illinois Malleable Iron Co., Chicago, Ill.
- Jarecki Mfg. Co., Erie, Pa.
- Jefferson Union Co., Lexington, Mass.
- Jones & Laughlin Steel Corp., Pittsburgh, Pa.
- Kennedy Valve Mfg. Co., Elmira, N. Y.
- King Union Co., Inc., Hillsgrove, R. I.
- ●Malleable Iron Fittings Co., Branford, Conn.
- ●Mueller Brass Co., Port Huron, Mich.
- National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
- Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
- Pittsburgh Valve & Fittings Corp., Barberton, O.
- Ravena Iron Co., Ravena, N. Y. (Cast iron).
- Republic Steel Corp., Cleveland, O.
- Rockford Brass Works, Rockford, Ill.
- Semler Co., Jeannette, Pa.
- Stockham Pipe Fittings Co., Birmingham, Ala.
- Superior Railway Products Corp., Pittsburgh, Pa.
- ●Taylor Forge & Pipe Wks., Chicago, Ill.
- Victaulic Co. of America, New York, N. Y.
- Vogt Machine Co., Henry, Louisville, Ky.
- Walworth Co., New York, N. Y.
- Ward Foundries, Inc., J. P., Blossburgh, Pa.
- ●Watson-Stillman Co., Roselle, N. J.
- Weatherhead Co., Cleveland, O.
- Wheeling Machine Products Co., Wheeling, W. Va.
- ●Youngstown Sheet & Tube Co., Youngstown, O.

CUT-OFFS, LOW WATER, HEATING BOILER

- Bender Warrick Corp., Birmingham, Mich.
- ●General Controls Co., Glendale, Calif.
- Kieley & Mueller, Inc., New York, N. Y.
- ●Maid-O'-Mist, Inc., Chicago, Ill.
- ●McAlear Mfg. Co., Chicago, Ill.
- ●McDonnell & Miller, Chicago, Ill.
- Mercoid Corp., The, Chicago, Ill.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- Penn Electric Switch Co., Goshen, Ind.

● Advertisement in this issue. See Index to Advertisers, page 326.

Schaub Engineering Co., Fred H., Chicago, Ill.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

CUTTERS, PIPE

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Barnes Tool Co., The, New Haven, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Bernz Co., Inc., Otto, Rochester, N. Y.
Crown Die & Tool Co., Chicago, Ill.
Erie Tool Works, Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hollands Mfg. Co., Erie, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
International Nutyp Tool Co., Oswego, N. Y.
Jarecki Mfg. Co., Erie, Pa.
●National Machine Wks., Chicago, Ill.
Nye Tool & Machine Works, The, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Ridge Tool Co., Elyria, O.
Sac Tool Mfg. Co., St. Louis, Mo.
Toledo Pipe Threading Machine Co., Toledo, O.
Trimont Mfg. Co., Boston, Mass.
Vanderman Mfg. Co., Willimantic, Conn.
Wallace Supplies Mfg. Co., Chicago, Ill.
Weatherhead Co., Cleveland, O.

CUTTERS, TUBING

Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Bernz Co., Inc., Otto, Rochester, N. Y.
Bonney Forge & Tool Works, Allentown, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Mueller Brass Co., Port Huron, Mich.
Nye Tool & Machine Works, The, Chicago, Ill.
Parker Appliance Co., Cleveland, O.
Perfection Refrigeration Parts Co., Harvey, Ill.
Ridge Tool Co., Elyria, O.
Sac Tool Mfg. Co., St. Louis, Mo.
Snap-On Tools Corp., Kenosha, Wis.
Trimont Mfg. Co., Boston, Mass.
Wallace Supplies Mfg. Co., Chicago, Ill.

DAMPER OPERATORS

See Operators, Damper

DAMPER REGULATORS

See Regulators, Damper Sets

DAMPERS, DUCT, MANUALLY OPERATED

Acme Tin Plate & Roofing Supply Co., Philadelphia, Pa.
Corbman Bros., Inc., Philadelphia, Pa.
Elgo Shutter & Mfg. Co., Detroit, Mich.
Excelsior Steel Furnace Co., Chicago, Ill.
Jacobs Co., B. & J., Cincinnati, O.
Kerentoff, G. L., Cincinnati, O.
Salina Metal Products Co., Salina, Kans.
Waterloo Register Co., Waterloo, Ia.

DAMPERS, DUCT, REMOTE CONTROLLED

Air Conditioning Products Co., Detroit, Mich.
American Warming & Ventilating Co., Toledo, O.
Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Brooke Engineering Co., Inc., Philadelphia, Pa.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penn Electric Switch Co., Goshen, Ind.
●Powers Regulator Co., Chicago, Ill.
Shallcross Controls, Inc., Milwaukee, Wis.
Stuart Co., W. W., Des Moines, Ia.
●Tuttle & Bailey, Inc., New Britain, Conn.
Vapor Car Heating Co., Inc., Chicago, Ill.
Waterloo Register Co., Waterloo, Ia.
Young Regulator Co., Cleveland, O.

DEAERATORS

●Cochrane Corp., Philadelphia, Pa.
Croll-Reynolds Engrg. Co., Inc., New York, N. Y.
Elliott Co., Jeannette, Pa.
Graver Tank & Mfg. Co., Inc., East Chicago, Ind.
Heat Transfer Products, Inc., New York, N. Y.
Hoppes Mfg. Co., Springfield, O.
Permutit Co., New York, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Sims Co., Erie, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Swartwout Co., Cleveland, O.
●Worthington Pump & Machinery Corp., Harrison, N. J.

DEEP WELL PUMPS

See Pumps, Deep Well

DEHUMIDIFIERS, ABSORPTION AND ADSORPTION

●Air & Refrigeration Corp., New York, N. Y.
American Injector Co., Detroit, Mich.
Aqua-Sorb Co., East Orange, N. J.
●Bryant Heater Co., The, Cleveland, O. (Silica gel)
Carbide and Carbon Chemicals Corp., New York, N. Y. (Triethylene Glycol)
Carrier Corp., Syracuse, N. Y.
Davison Chemical Corp., The, Baltimore, Md.
General Air Conditioning Corp., Cincinnati, O.
Kaufman, H. J., Detroit, Mich.
Pittsburgh Lectrodryer Corp., Pittsburgh, Pa.
Research Corp., New York, N. Y.
Solvay Sales Corp., New York, N. Y.
●Surface Combustion Corp., Toledo, O.

DEHUMIDIFYING UNITS

See Units, Air Conditioning; Dehumidifiers, Absorption and Adsorption

DEHYDRANT AND ACID NEUTRALIZER, FOR REFRIGERATING SYSTEMS

American Injector Co., Detroit, Mich.
Davison Chemical Corp., The, Baltimore, Md.
Highside Chemicals Co., Newark, N. J.
Imperial Brass Mfg. Co., Chicago, Ill.

DESUPERHEATERS, STEAM

Edge Moor Iron Works, Inc., New York, N. Y.
Foster Wheeler Corp., New York, N. Y.
Hagan Corp., Pittsburgh, Pa.
Northern Equipment Co., Erie, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.

DETECTORS, LEAK, REFRIGERANT

Bernz Co., Inc., Otto, Rochester, N. Y.
Imperial Brass Mfg. Co., Chicago, Ill.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill. (Leak alarm)
Turner Brass Wks., Sycamore, Ill.

DIAPHRAGM VALVES

See Valves, Diaphragm

DIESEL ENGINES

See Engines, Diesel, for Fan, Pump and Compressor Drives

DIFFUSERS, AIR, HIGH VELOCITY

Air Devices, Inc., New York, N. Y.
●Anemostat Corp. of America, New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
●Connor Engineering Corp., W. B., Dorex Div., New York, N. Y.
Demuth & Sons, Charles, Garden City Park, L. I.
●Tuttle & Bailey, Inc., New Britain, Conn.
Waterloo Register Co., Waterloo, Ia.

DOOR CONTROLS

See Controls, Door, Electric Eye

DOORS AND PANELS, ACCESS

American Foundry & Furnace Co., Bloomington, Ill.
American Sheet Metal Works, New Orleans, La.
●Auer Register Co., Cleveland, O.
●Clarage Fan Co., Kalamazoo, Mich.
Falstrom Co., Passaic, N. J.
Higgin Products, Inc., Newport, Ky.
Kirk & Blum Mfg. Co., Cincinnati, O.
Lawson Co., F. H., Cincinnati, O.
Milcor Steel Co., Milwaukee, Wis.
Rock Island Register Co., Rock Island, Ill.
Truscon Steel Co., Youngstown, O.
●Tuttle & Bailey, Inc., New Britain, Conn.
Way Loctor Access Panel Co., Boston, Mass.

DRAFT CONTROL

See Controls, Draft, Barometric; Regulators, Draft, Combustion

DRAFT GAGES

See Gages, Indicating, Draft

DRAFT RECORDERS

See Recorders, Draft

DRAFT REGULATORS

See Controls, Draft, Barometric; Regulators, Draft, Combustion

DRILLS, ELECTRIC, PORTABLE

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., New York, N. Y.
Cincinnati Electrical Tool Co., The, Cincinnati, O.
Clark, Jr., Electric Co., Jas., Louisville, Ky.
Independent Pneumatic Tool Co., Chicago, Ill.
Mall Tool Co., Chicago, Ill.
Millers Falls Co., Greenfield, Mass.
Misener Mfg. Co., Inc., Syracuse, N. Y.
Paramount Products Co., New York, N. Y.
Power King Tool Corp., Warsaw, Ind.
Signal Electric Mfg. Co., Menominee, Mich.
Skilsaw, Inc., Chicago, Ill.
Snap-On Tools Corp., Kenosha, Wis.

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Speedway Mfg. Co. (Cicero), Ill.
Stanley Electric Tool Div., The Stanley Works, New Britain, Conn.
Syntron Co., Homer City, Pa.
U. S. Electrical Tool Co., Cincinnati, O.
Van Dorn Electric Tool Co., Towson, Md.
Willy's Carbide Tool Co., Detroit, Mich.
Wodack Electric Tool Corp., Chicago, Ill.

DRIVES, CHAIN

Caldwell Co., W. E., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Indianapolis, Ind.
Medart Co., St. Louis, Mo.
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Whitney Chain & Mfg. Co., The, Hartford, Conn.

DRIVES, FLAT BELT

See also Belting, Leather and Belting, Rubber

American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
Caldwell Co., W. E., Louisville, Ky.
Chicago Belting Co., Chicago, Ill.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Dick Co., Inc., R. & J., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
Medart Co., St. Louis, Mo.
●Rhoads & Sons, J. E., Philadelphia, Pa.
Rockwood Mfg. Co., Indianapolis, Ind.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
Williams & Son, I. B., Dover, N. H.
Wood's Sons Co., T. B., Chambersburg, Pa.

DRIVES, V BELT

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
Chicago Belting Co., Chicago, Ill.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Congress Die Casting Div., Congress Tool & Die Co., Detroit, Mich.
Continental Rubber Wks., Erie, Pa.
Dayton Rubber Mfg. Co., Dayton, O.
Dick Co., Inc., R. & J., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
Fairbanks, Morse & Co., Chicago, Ill.
Gates Rubber Co., Denver, Colo.
Goodrich Co., B. F., Akron, O.
Horton Mfg. Co., Minneapolis, Minn.
Ideal Commutator Dresser Co., Sycamore, Ill.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Medart Co., St. Louis, Mo.
Pyott Foundry & Machine Co., Chicago, Ill.
Rockwood Mfg. Co., Indianapolis, Ind.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
Wood's Sons Co., T. B., Chambersburg, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

DUAL THERMOSTATS

See Thermostats, Two Temperature or Dual

DUCT CONNECTIONS

See Connections, Duct, Flexible

DUCT HEATERS

See Heaters, Duct

DUCT INSULATION

See Insulation, Duct

DUCT THERMOSTATS

See Thermostats, Duct Type

DUCT TURNING VANES

See Vanes, Duct Turning, Prefabricated

DUCTS AND DUCT FITTINGS, PREFABRICATED

Acer & Whedon, Medina, N. Y.
Acme Tin Plate & Roofing Supply Co., Philadelphia, Pa.
●Carey Mfg. Co., Philip, Cincinnati, O.
Champion Furnace Pipe Co., Peoria, Ill.
Chandler Co., Cedar Rapids, Ia.
Char-Gale Mfg. Co., Minneapolis, Minn.
Chicago Furnace Supply Co., Chicago, Ill.
Cincinnati Sheet Metal & Roofing Co., Cincinnati, O.
Corbman Bros., Inc., Philadelphia, Pa.
Excelsior Steel Furnace Co., Chicago, Ill.
Gray Metal Products, Inc., Rochester, N. Y.
Henry Furnace & Foundry Co., Cleveland, O.
Howes-Woods Co., Charlestown, Boston, Mass.
Jacobs Co., B. & J., Cincinnati, O.
Lamneck Products, Inc., Middletown, O.
Meyer & Bro. Co., F., Peoria, Ill.
Milcor Steel Co., Milwaukee, Wis.
Moncrief Furnace Co., Atlanta, Ga.
●Mueller Furnace Co., L. J., Milwaukee, Wis.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Season-Aire Corp. of America, Detroit, Mich.
Smith-Raymond Co., Columbus, Ga.
United States Register Co., Battle Creek, Mich.
Williamson Heater Co., Cincinnati, O.

DUST COLLECTORS

See Collectors, Dust

DUST COUNTERS

See Counters, Dust

EJECTORS, SEWAGE

American-Marsh Pumps, Inc., Battle Creek, Mich.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Works Co., Columbus, O.
Economy Pumps, Inc., Hamilton, O.
●Nash Engineering Co., South Norwalk, Conn.
Penberthy Injector Co., Detroit, Mich.
Quimby Pump Co., Inc., Newark, N. J.
Schutte & Koerting Co., Philadelphia, Pa.
Taber Pump Co., Inc., Buffalo, N. Y.
Well Pump Co., Chicago, Ill.
Yeomans Bros. Co., Chicago, Ill.

ELECTRIC AIR CLEANERS

See Cleaners, Air, Electrical

ELECTRIC DRILLS

See Drills, Electric, Portable

ELECTRIC MOTORS

See Motors, Electric

ELECTRIC SHEARS

See Shears, Electric, Portable

ELECTRIC UNIT HEATERS

See Heaters, Unit, Electric Heating Element

ELECTRIC WATER HEATERS

See Heaters, Water, Electric

ELECTRODES, ARC WELDING

●Air Reduction Sales Co., New York, N. Y.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Aluminum Co. of America, Pittsburgh, Pa.
American Agile Corp., Cleveland, O.
●American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Cleveland, O.
Arcos Corp., Philadelphia, Pa.
Chicago Steel & Wire Co., Chicago, Ill.
Electric Arc, Inc., Newark, N. J.
Ergolyte Mfg. Co. Philadelphia, Pa.
●General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee, Wis.
Hobart Bros., Troy, O.
Lincoln Electric Co., Cleveland, O.
Marquette Mfg. Co., Minneapolis, Minn.
Maurath, Inc., Cleveland, O.
McKay Co., York, Pa.
Metal & Thermit Corp., New York, N. Y.
National Cylinder Gas Co., Chicago, Ill.
Page Steel & Wire Division of American Chain & Cable Co., Inc., Monessen, Pa.
Revere Copper and Brass, Incorporated, New York, N. Y.
Roebling's Sons, John A., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Torchweld Equipment Div., National Cylinder Gas Co., Chicago, Ill.
Trindl Products, Ltd., Chicago, Ill.
Una Welding, Inc., E. Cleveland, O.
Universal Power Corp., Cleveland. O.
Welding Apparatus Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wilson Welder & Metals Co., Inc., New York, N. Y.

ELIMINATORS, AIR, FOR HEATING AND PIPING SYSTEMS

●Anderson Co., V. D., The, Cleveland, O.
●Anderson Products, Inc., Cambridge, Mass.
●Armstrong Machine Works, Three Rivers, Mich.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
●Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
●Maid-O'-Mist, Inc., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
●Sarco Co., Inc., New York, N. Y.
Sterling, Inc., Milwaukee, Wis.
Triplex Heating Specialty Co., Peru, Ind.
Vapor Specialty Co., New York, N. Y.
Wright-Austin Co., Detroit, Mich.

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ENAMELS AND LACQUERS

Acme White Lead & Color Works, Detroit, Mich.
Acorn Refining Co., Cleveland, O.
Baer Bros., New York, N. Y.
Debevoise Co., The, Brooklyn, N. Y.
Detroit Graphite Co., Detroit, Mich.
Dragert Co., Inc., C. H., Brooklyn, N. Y.
du Pont de Nemours & Co. (Inc.), E. I., Fabrics & Finishes Dept., Wilmington, Del.
Fales Chemical Co., Inc., The, New York, N. Y.
Ferro-Enamel Corp., Cleveland, O.
Glidden Co., Cleveland, O.
Hague & Co., Inc., Alfred, Brooklyn, N. Y.
Hilo Varnish Corp., Brooklyn, N. Y.
Horn Co., A. C., Long Island City, N. Y.
Inter-Coastal Paint Corp., East St. Louis, Ill.
Krehbiel Co., J. H., Chicago, Ill.
Maas & Waldstein Co., Newark, N. J.
O'Brien Varnish Co., South Bend, Ind.
Quigley Co., Inc., New York, N. Y.
Roxalin Flexible Lacquer Co., Inc., Elizabeth, N. J.
Sonneborn Sons, Inc., L., New York, N. Y.
Thompson & Co., Pittsburgh, Pa.
Tropical Paint & Oil Co., Cleveland, O.
Wailes Dove-Hermiston Corp., Westfield, N. J.
Wilhelm Co., A., Reading, Pa.
Zapon-Brevolite Div., Atlas Powder Co., North Chicago, Ill.

ENGINES, DIESEL, FOR FAN, PUMP AND COMPRESSOR DRIVES

American Locomotive Co., Auburn, N. Y.
Anderson Engine & Foundry Co., Anderson, Ind.
Buda Co., Harvey, Ill.
Caterpillar Tractor Co., Peoria, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
De La Vergne Engine Co., Philadelphia, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
General Motors Corp., Detroit, Mich.
Hill Diesel Engine Co., Lansing, Mich.
Ingersoll-Rand, New York, N. Y.
Waukesha Motor Co., Waukesha, Wis.
Witte Engine Works, Kansas City, Mo.
●Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES, GAS, FOR FAN, PUMP AND COMPRESSOR DRIVES

Bardco Corp. of America, Los Angeles, Cal.
Caterpillar Tractor Co., Peoria, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.
●Continental Motors Corp., Detroit, Mich.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Fairbanks, Morse & Co., Chicago, Ill.
Ingersoll-Rand, New York, N. Y.
U. S. Motors Corp., Oshkosh, Wis.
Universal Motor Co., Oshkosh, Wis.
Waukesha Motor Co., Waukesha, Wis.
Williamsport Engine & Machine Co., Williamsport, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES, STEAM, FOR FAN, PUMP AND COMPRESSOR DRIVES

Ames Iron Wks., Div. of Pierce, Butler Radiator Corp., Oswego, N. Y.
Elliott Co., Jeannette, Pa.
●Frick Co., Waynesboro, Pa.
Harrisburg Fdry. & Mach. Co., Inc., Harrisburg, Pa.
Morris Machine Wks., Baldwinsville, N. Y.
Murray Iron Wks Co., Burlington, Ia.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Skinner Engine Co., Erie, Pa.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Troy Engine & Machine Co., Troy, Pa.
●Vilter Mfg. Co., Milwaukee, Wis.

EVAPORATIVE CONDENSERS

See Condensers, Refrigerating, Evaporative

EXHAUST HEADS

See Heads, Exhaust, for Pipe Lines

EXPANSION BENDS

See Bends, Expansion

EXPANSION BOLTS

See Bolts, Expansion

EXPANSION JOINTS

See Joints, Pipe, Expansion

EXPANSION TANKS

See Tanks, Expansion, for Hot Water Heating Systems

EXPANSION VALVES

See Valves, Refrigeration

EXTRACTORS, PIPE

Greenfield Tap & Die Corp., Greenfield, Mass.
Reps Tool, Inc., Buffalo, N. Y.
Ridge Tool Co., Elyria, O.

FABRICATED PIPING

See Bends; Headers; Joints; etc.

FABRICATORS, PIPE

See Headers, Welded; and Coils, Pipe

FAN BASES

See Bases and Pads, Vibration Isolating

FAN BLADES

See Blades, Propeller Fan

FAN HOUSINGS

See Housings, Fan, Centrifugal

FANS, CENTRIFUGAL

Advance Aluminum Castings Corp., Chicago, Ill.
Advance Fan & Blower Co., Detroit, Mich.
Air Controls, Inc., Cleveland, O.
●Airtherm Mfg. Co., St. Louis, Mo.
Allen Billmyre Corp., Mamaroneck, N. Y.
American Blower Corp., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American Furnace Co., St. Louis, Mo.
Ames Co., W. R., San Francisco, Cal.
Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.
Ballantyne Co., Omaha, Nebr.
Bayley Blower Co., Milwaukee, Wis.
Berns Specialty Co., Chicago, Ill.
●Bishop & Babcock Mfg. Co., Cleveland, O.
Blower Application Co., Milwaukee, Wis.
Brundage Co., The, Kalamazoo, Mich.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., Des Moines, Ia.
Carrier Corp., Syracuse, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
●Clarage Fan Co., Kalamazoo, Mich.
Coppus Engineering Corp., Worcester, Mass.
Duriron Co., Inc., Dayton, O. (Acid resisting).
Eclipse Fuel Engineering Co., Rockford, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Essick Mfg. Co., Los Angeles, Cal.
Furblo Co., Hermansville, Mich.
Garden City Fan Co., Chicago, Ill.
General Blower Co., Inc., Philadelphia, Pa.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Grand Rapids Die & Tool Co., Grand Rapids, Mich.
Hall Mfg. Co., Cedar Rapids, Ia.
Hastings Air Conditioning Co., Hastings, Neb.
●Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Nebr.
Janette Mfg. Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Johnson Fan & Blower Corp., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
Lau Blower Co., Dayton, O.
Lehigh Fan & Blower Co., Allentown, Pa.
Leinweber Fan & Blower Co., Chicago, Ill.
Magirl Foundry & Furnace Works, P. H., Bloomington, Ill.
Maple City Stamping Co., Peoria, Ill.
Montag Stove & Furnace Wks., Portland, Ore.
Morrison Products, Inc., Cleveland, O.
Mountain States Equipment Co., Denver, Colo.
National Mfg. & Engineering Co., Detroit, Mich.
New York Blower Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Northern Blower Co., Cleveland, O.
Palmer Mfg. Corp., Phoenix, Ariz.
Peerless Electric Co., Warren, O.
Phelps Mfg. Co., Little Rock, Ark.
Reynolds Mfg. Co., The, Grand Rapids, Mich.
Royal Air Conditioning Equipment Co., Alhambra, Cal.
Schwitzer-Cummins Co., Indianapolis, Ind.
Semco Mfg. Co., Nashville, Tenn.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Smith Heater Co., Peter, Detroit, Mich.
Spray-Wheel Air Conditioners, Inc., Denver, Colo.
●Sturtevant Co., B. F., Boston, Mass.
Supreme Heater & Ventilating Corp., Bonner Springs, Kans.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
Trade-Wind Motorfans, Inc., Los Angeles, Cal.
●Trane Co., LaCrosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Viking Air Conditioning Corp., Cleveland, O.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.

FANS, PROPELLER

Aerovent Fan Co., Piqua, O.
Air Controls, Inc., Cleveland, O.
Aire-Foile Fan & Blower Co., Detroit, Mich.
Airmaster Corp., Chicago, Ill.
●Airtherm Mfg. Co., St. Louis, Mo.

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Allen Corp., Detroit, Mich.
American Blower Corp., Detroit, Mich.
American Coolair Corp., Jacksonville, Fla.
Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Belanger Fan & Blower Co., Detroit, Mich.
Belco Exhaust Fan Mfg. Co., St. Louis, Mo.
Berns Specialty Co., Chicago, Ill.
●Bishop & Babcock Mfg. Co., Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
Chelsea Fan & Blower Co., Irvington, N. J.
Circulators & Devices Mfg. Corp., New York, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Coppus Engineering Corp., Worcester, Mass.
Dallas Engineering Co., Inc., Dallas, Tex.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Diehl Mfg. Co., Elizabethport, N. J.
Dual Air Fan Co., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Emerson Electric Mfg. Co., The, St. Louis, Mo.
Esko Mfg. Corp., Houston, Tex.
Fresh'nd-Aire Co., Chicago, Ill.
Garden City Fan Co., Chicago, Ill.
General Blower Co., Inc., Philadelphia, Pa.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Guth Co., Edwin F., St. Louis, Mo.
Hall Mfg. Co., Cedar Rapids, Ia.
Hartzell Propeller Fan Co., Piqua, O.
Hirschman Co., W. F., Buffalo, N. Y.
Holtum Mfg. Co., Freeport, Ill.
Hunter Fan & Ventilating Co., Inc., Memphis, Tenn.
●Ilg Electric Ventilating Co., Chicago, Ill.
International Engineering, Inc., Dayton, O.
Jamieson Mfg. Co., Dallas, Tex.
Jeffrey Mfg. Co., Columbus, O.
Johnson Fan & Blower Corp., Chicago, Ill.
Johnston Co., William W., Dayton, O.
Jordan & Co., Paul R., Indianapolis, Ind.
King Ventilating Co., Owatonna, Minn.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Kisco Co., Inc., St. Louis, Mo.
Lau Blower Co., Dayton, O.
Lohman Co., Wm. J., Irvington, N. J.
Marathon Electric Mfg. Corp., Wausau, Wis.
●McCord Radiator & Mfg. Co., Detroit, Mich.
Meier Electric & Machine Co., Indianapolis, Ind.
Mountain States Equipment Co., Denver, Colo.
Myers Electric Co., Inc., Pittsburgh, Pa.
New York Blower Co., Chicago, Ill.
Peerless Electric Co., Warren, O. (Disc).
Perkins & Son, Inc., B. F., Holyoke, Mass.
Phelps Mfg. Co., Little Rock, Ark.
Pritchard & Co., J. F., Kansas City, Mo.
Propellair, Inc., Springfield, O.
Reed Unit-Fans, Inc., New Orleans, La.
Reynolds Electric Co., Chicago, Ill.
Royal Air Conditioning Equipment Co., Alhambra, Cal.
Schwitzer-Cummins Co., Indianapolis, Ind.
Scott-Newcomb, Inc., St. Louis, Mo.
Semco Mfg. Co., Nashville, Tenn.
Signal Electric Mfg. Co., Menominee, Mich.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
South Bend Air Products Corp., South Bend, Ind.
Spray Engineering Co., Somerville, Mass.
●Sturtevant Co., B. F., Boston, Mass.
Swift Mfg. Co., Detroit, Mich.
Trade-Wind Motorfans, Inc., Los Angeles, Cal.
●Trane Co., La Crosse, Wis.
Truflo Fan Co., Harmony, Pa.
●U S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Victor Electric Products, Inc., Cincinnati, O.
Viking Air Conditioning Corp., Cleveland, O.
Western Blower Co., Seattle, Wash.
Western Engineering & Mfg. Co., Los Angeles, Cal.
●Wing Mfg. Co., L. J., New York, N. Y.

FEEDERS, WATER, HEATING BOILER

Beaton & Cadwell Mfg. Co., New Britain, Conn.
Cissell Mfg. Co., W. M., Louisville, Ky.
Davis Regulator Co., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Healy Ruff Co., St. Paul, Minn.
Kieley & Mueller, Inc., New York, N. Y.
Kisco Boiler & Engineering Co., St. Louis, Mo.
●Maid-O'-Mist, Inc., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Nason Co., Detroit, Mich.
Schaub Engineering Co., Fred H., Chicago, Ill.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

FIBER PACKING

See Packing, Fiber

FILTER GAGES

See Gages, Air Filter

FILTERS, AIR, AUTOMATIC

●Air & Refrigeration Corp., New York, N. Y.
Air-Stream Filter Corp., St. Louis, Mo.
●American Air Filter Co., Inc., Louisville, Ky.
Brauer Supply Co., A. G., St. Louis, Mo.
●Staynew Filter Corp., Rochester, N. Y.

FILTERS, AIR, UNIT, CLEANABLE

●Air-Maze Corp., Cleveland, O.
Air-Stream Filter Corp., St. Louis, Mo.
●American Air Filter Co., Inc., Louisville, Ky.
Amirton Co., Inc., New York, N. Y.
Annis Air Filters, Glendale, Cal.
Brauer Supply Co., A. G., St. Louis, Mo.
Chicago Filter Co., Joliet, Ill.
Coppus Engineering Corp., Worcester, Mass.
Davies Air Filter Corp., New York, N. Y.
Hugo Mfg. Co., West Duluth, Minn.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kleenaire Corp., Stevens Point, Wis.
●Somers, Inc., H. J., Detroit, Mich.
●Staynew Filter Corp., Rochester, N. Y.
Supreme Air Filter Co., New York, N. Y.
Tuttle Air Filter Co., Inc., Louisville, Ky.
Universal Air Filter Corp., Duluth, Minn.

FILTERS, AIR, UNIT, THROW-AWAY

●American Air Filter Co., Inc., Louisville, Ky.
Amirton Co., Inc., New York, N. Y.
●Anderson Products, Inc., Cambridge, Mass.
Blocksom & Co., Michigan City, Ind.
Chicago Filter Co., Joliet, Ill.
Davies Air Filter Corp., New York, N. Y.
●Detroit Lubricator Co., Detroit, Mich.
Gehri Co., Tacoma, Wash.
Kleenaire Corp., Stevens Point, Wis.
●Owens-Corning Fiberglas Corp., Toledo, O.
Plymouth Cordage Co., N. Plymouth, Mass.; Anderson Products, Inc., Cambridge, Mass. National Sales Agents.
●Research Products Corp., Madison, Wis.
●Staynew Filter Corp., Rochester, N. Y.
Universal Air Filter Corp., Duluth, Minn.
Wilson & Co., Chicago, Ill.

FILTERS, ODOR

See Adsorbers, Odor

FILTERS, PIPE LINE

Adams Co., Inc., R. P., Buffalo, N. Y.
●Alco Valve Co., St. Louis, Mo.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
●Cochrane Corp., Philadelphia, Pa.
Cuno Engineering Corp., Meriden, Conn.
Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
●Fisher Governor Co., Marshalltown, Ia.
General Motors Corp., Moraine Products Div., Dayton, O.
Graver Tank & Mfg. Co., Inc., East Chicago, Ind.
Johnson Corp., Three Rivers, Mich.
Kraissl Co., Inc., The, Hackensack, N. J.
Mason-Neilan Regulator Co., Boston, Mass.
Monmouth Products Co., Cleveland, O.
Newark Wire Cloth Co., Newark, N. J.
Permutit Co., New York, N. Y.
Refinite Corp., Omaha, Neb.
Rega Mfg. Co., Rochester, N. Y.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Scientific Instrument Co., Detroit, Mich.
●Staynew Filter Corp., Rochester, N. Y.
Superior Valve & Fittings Co., Pittsburgh, Pa.

FINNED TUBING

See Tubing, Finned

FIRE PUMPS

See Pumps, Fire

FITTINGS, BLOW PIPE

Acer & Whedon, Medina, N. Y.
Allington & Curtis Mfg. Co., Saginaw, Mich.
Chicago Metal Mfg. Co., Chicago, Ill.
Cincinnati Sheet Metal & Roofing Co., Cincinnati, O.
●Day Co., The, Minneapolis, Minn.
Falstrom Co., Passaic, N. J.
Goethel Co., Alfred C., Milwaukee, Wis.
Goethel Sheet Metal Works, Alfred, Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
●Industrial Sheet Metal Works, Inc., Detroit, Mich.
Kirk & Blum Mfg. Co., Cincinnati, O.
Lee & Son Co., Thomas, Cincinnati, O.

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Mahon Co., R. C., Detroit, Mich.
Meyer & Bro. Co., F., Peoria, Ill.
Puhl & Hepper Mfg. Co., Inc., St. Louis, Mo.
Schmieg Sheet Metal Works, Detroit, Mich.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Tiffin Eaves Trough Clamp Co., Tiffin, O.
United States Register Co., Battle Creek, Mich.
Western Blower Co., Seattle, Wash.
Young & Bertke Co., Cincinnati, O.

FITTINGS, COPPER TUBE, COMPRESSION

●American Brass Co., Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.
Crane Co., Chicago, Ill.
Dole Valve Co., The, Chicago, Ill.
Dresser Mfg. Co., Bradford, Pa.
●Grinnell Co., Inc., Providence, R. I.
Hays Mfg. Co., Erie, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
●Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Packless Metal Products Corp., New Rochelle, N. Y. (Self-flaring)
Parker Appliance Co., Cleveland, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Superseal Corp., New York, N. Y.
VibraSeal Corp., Detroit, Mich.

FITTINGS, COPPER TUBE, SOLDER

●American Brass Co., Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Crane Co., Chicago, Ill.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
Imperial Brass Mfg. Co., Chicago, Ill.
●Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Parker Appliance Co., Cleveland, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Walworth Co., New York, N. Y. (Brazed)

FITTINGS, DRAINAGE, FIXED AIR BREAK

American Sterilizer Co., Erie, Pa.
Scanlan-Morris Co., Madison, Wis.

FITTINGS, HOT WATER HEATING SYSTEMS, ONE PIPE

●Bell & Gossett Co., Morton Grove, Ill.
Kehm Corp., The, Chicago, Ill.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
Triplex Heating Specialty Co., Peru, Ind.

FITTINGS, LINED

Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
American Hard Rubber Co., New York, N. Y. (Rubber)
Goodrich Co., B. F., Akron, O. (Rubber)
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead and tin)
National Lead Co., New York, N. Y. (Lead)
Northern Indiana Brass Co., Elkhart, Ind. (Tinned)
Resisto Pipe & Valve Co., East Cambridge, Mass.
United States Rubber Co., New York, N. Y. (Rubber)

FITTINGS, PIPE, BRASS, SOLDER

●American Brass Co., Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Crane Co., Chicago, Ill.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
●Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Parker Appliance Co., Cleveland, O.
Walworth Co., New York, N. Y. (Brazed)

FITTINGS, PIPE, BRASS, THREADED

Acheson Mfg. Co., Rankin, Pa.
American Manganese Bronze Co., Philadelphia, Pa.
Belfield Co., H., Philadelphia, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.
Crane Co., Chicago, Ill.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
●Mueller Brass Co., Port Huron, Mich.
New York Brass Fdry., New York, N. Y.
Parker Appliance Co., Cleveland, O.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Phoenix Brass Fittings Corp., Irvington, N. J.
Rockford Brass Works, Rockford, Ill.
Ross Sprinkler Co., Pasadena, Cal.
Union Metal Wks., Inc., Chelsea, Mass.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.

FITTINGS, PIPE, BRASS, WELDING

●American Brass Co., Waterbury, Conn.
Bonney Forge & Tool Wks., Allentown, Pa.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
●Tube-Turns, Louisville, Ky.
Walworth Co., New York, N. Y. (Brazed)

FITTINGS, PIPE, BRONZE, BRAZED

Crane Co., Chicago, Ill.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Walworth Co., New York, N. Y.

FITTINGS, PIPE, CAST IRON, FLANGED

Alabama Pipe Co., Anniston, Ala.
American Cast Iron Pipe Co., Birmingham, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
Crane Co., Chicago, Ill.
Duriron Co., Inc., Dayton, O. (Acid resisting)
Eastern Foundry Co., Boyertown, Pa.
●Frick Co., Waynesboro, Pa.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., The, Elmira, N. Y.
Kuhns Bros. Co., Dayton, O.
Lynchburg Foundry Co., Lynchburg, Va.
●National Machine Works, Chicago, Ill.
National Valve & Mfg. Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Semler Co., Jeannette, Pa.
Somerville Iron Works, Somerville, N. J.
Stockham Pipe Fittings Co., Birmingham, Ala.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
United States Pipe & Foundry Co., Burlington, N. J.
Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

FITTINGS, PIPE, CAST IRON, THREADED

Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Eastern Foundry Co., Boyertown, Pa.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
●Frick Co., Waynesboro, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kuhns Bros. Co., Dayton, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Ravena Iron Co., Ravena, N. Y.
Semler Co., Jeannette, Pa.
Somerville Iron Works, Somerville, N. J.
Stockham Pipe Fittings Co., Birmingham, Ala.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.

FITTINGS, PIPE, LEAD

Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Lead Lined Iron Pipe Co., Wakefield, Mass.
Lissberger & Son., Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.

FITTINGS, PIPE, MALLEABLE

Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Dresser Mfg. Co., Bradford, Pa.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
●Malleable Iron Fittings Co., Branford, Conn.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Stockham Pipe Fittings Co., Birmingham, Ala.
Victaulic Co. of America, New York, N. Y.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.

FITTINGS, PIPE, NICKEL AND NICKEL ALLOY

American Manganese Bronze Co., Philadelphia, Pa.
Bailey Meter Co., Cleveland, O.
Crane Co., Chicago, Ill.
International Nickel Co., New York, N. Y.
Parker Appliance Co., Cleveland, O.
●Tube-Turns, Louisville, Ky.

FITTINGS, PIPE, STEEL, FLANGED

Alloy Steel Products Co., Linden, N. J. (Stainless steel).
American Rolling Mill Co., The, Middletown, O.
Crane Co., Chicago, Ill.
Hasco Valve & Machine Co., Milwaukee, Wis. (Stainless steel only)
National Valve & Mfg. Co., Pittsburgh, Pa.

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●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Semet-Solvay Engrg. Corp., New York, N. Y.
●Taylor Forge & Pipe Wks., Chicago, Ill.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.

FITTINGS, PIPE, STEEL, FORGED, THREADED

Central Forging Co., Catawissa, Pa.
Crane Co., Chicago, Ill.
●Grinnell Co., Inc., Providence, R. I.
Henry Valve Co., Chicago, Ill.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.

FITTINGS, PIPE, STEEL, SOCKET WELD

Crane Co., Chicago, Ill.
●Grinnell Co., Inc., Providence, R. I.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
●Taylor Forge & Pipe Wks., Chicago, Ill.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.

FITTINGS, PIPE, STEEL, THREADED

Alloy Steel Products Co., Linden, N. J. (Stainless steel).
Central Forging Co., Catawissa, Pa.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
Crane Co., Chicago, Ill.
Harrisburg Steel Corp., Harrisburg, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis. (Stainless steel only)
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.

FITTINGS, PIPE, STEEL, WELDING

American Rolling Mill Co., The, Middletown, O.
Bonney Forge & Tool Wks., Allentown, Pa.
Crane Co., Chicago, Ill.
●Grinnell Co., Inc., Providence, R. I.
Larkin Packer Co., St. Louis, Mo.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Valve & Mfg. Co., Pittsburgh, Pa.
Oil Well Supply Co., Oil City, Pa.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Semet-Solvay Engineering Corp., New York, N. Y.
●Taylor Forge & Pipe Wks., Chicago, Ill.
●Tube-Turns, Louisville, Ky.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
Wedge Protectors, Inc., Cleveland, O. (Chill rings)

FITTINGS, PIPE, WROUGHT IRON, WELDING

Bonney Forge & Tool Wks., Allentown, Pa.
●Grinnell Co., Inc., Providence, R. I.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Valve & Mfg. Co., Pittsburgh, Pa.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
●Taylor Forge & Pipe Wks., Chicago, Ill.
●Tube-Turns, Louisville, Ky.

FITTINGS, REFRIGERATION

American Injector Co., Detroit, Mich.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Chase Brass & Copper Co., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.
Crane Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
Henry Valve Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kerotest Mfg. Co., Pittsburgh, Pa.
●Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Parker Appliance Co., Cleveland, O.
Superior Valve and Fittings Co., Pittsburgh, Pa.
●Vilter Mfg. Co., Milwaukee, Wis.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.
Weatherhead Co., Cleveland, O.
Wittenmeier Machinery Co., Chicago, Ill.
X L Refrigerating Co., Inc., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

FLANGE BOLTS

See Bolts and Studs, Flange

FLANGES, PIPE

American Rolling Mill Co., The, Middletown, O.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Clow & Sons, James B., Chicago, Ill.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
Crane Co., Chicago, Ill.
●Dart Mfg. Co., E. M., Providence, R. I.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Harrisburg Steel Corp., Harrisburg, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis. (Stainless steel only)
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kuhns Bros. Co., Dayton, O.
Limbert & Co., Geo. B, Chicago, Ill.
Lynchburg Foundry Co., Lynchburg, Va.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
●National Machine Works, Chicago, Ill.
National Valve & Mfg. Co., Pittsburgh, Pa.
Naylor Pipe Co., Chicago, Ill.
Pennsylvania Forge Co., Philadelphia, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
Ravena Iron Co., Ravena, N. Y.
Rhode Island Fittings Co., Hillsgrove, R. I.
Semet-Solvay Engineering Corp., New York, N. Y.
Semler Co., Jeannette, Pa.
Steel Improvement & Forge Co., Cleveland, O.
Stockham Pipe Fittings Co., Birmingham, Ala.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
●Taylor Forge & Pipe Wks., Chicago, Ill
●Tube-Turns, Louisville, Ky.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
Warren Foundry & Pipe Corp., New York, N. Y.

FLEXIBLE COUPLINGS

See Couplings, Flexible

FLEXIBLE DUCT CONNECTIONS

See Connections, Duct, Flexible

FLEXIBLE METAL HOSE

See Hose, Metal, for Eliminating Compressor Vibration

FLOAT SWITCHES

See Switches, Float

FLOAT VALVES

See Valves, Float

FLOATS, STEAM TRAP, ETC.

Clark Controller Co., Cleveland, O.
Cryer Trap & Valve Co., Inc., New York, N. Y.
●Fisher Governor Co., Marshalltown, Ia.
Harris & Co., Arthur, Chicago, Ill.
Hercules Float Wks., Springfield, Mass.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Kieley & Mueller, Inc., New York, N. Y.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Naugatuck Mfg. Co., Union City, Conn.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Reichert Float & Mfg. Co., Toledo, O.
Reliance Gauge Column Co., Cleveland, O.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Sterling, Inc., Milwaukee, Wis.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
●Trane Co., LaCrosse, Wis.
Vapor Specialty Co., New York, N. Y.
Watson & McDaniel Co., Philadelphia, Pa.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

FLOOR AND CEILING PLATES

See Plates, Floor and Ceiling

FLOW CONTROL VALVES

See Valves, Flow Control

FLOW METERS

See Meters, Flow

FLOW SWITCHES

See Switches, Flow

FORGED STEEL VALVES

See Valves, Forged Steel

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FURNACES, WARM AIR, FOR INDUSTRIAL AND LARGE BUILDING HEATING

Acme Heating & Ventilating Co., Inc., Chicago, Ill.
Air Devices, Inc., New York, N. Y.
●Airtherm Mfg. Co., St. Louis, Mo.
American Foundry & Furnace Co., Bloomington, Ill.
Arcweld Mfg. Co., Inc., Seattle, Wash.
Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Beck Engineering Combustion Kompany, St. Louis, Mo.
●Bryant Heater Co., The, Cleveland, O.
Campbell Heating Co., Des Moines, Ia.
Campbell Heating Co., E. K., Kansas City, Mo.
Essick Mfg. Co., Los Angeles, Cal.
Jackson & Church Co., Saginaw, Mich.
Lee Engineering Co., Youngstown, O.
Lennox Furnace Co., Marshalltown, Ia., Syracuse, N. Y., and Columbus, O.
Magirl Foundry & Furnace Wks., P. H., Bloomington, Ill.
Majestic Co., Huntington, Ind.
Mayflower Air-Conditioners, Inc., St. Paul, Minn.
McCann Furnace Co., Cleveland, O.
McLouth Air Conditioning Corp., Lansing, Mich.
McPherson Furnace & Supply Co., Portland, Ore.
Moncrief Furnace Co., Atlanta, Ga.
Montag Stove & Furnace Wks., Portland, Ore.
●Mueller Furnace Co., L. J., Milwaukee, Wis.
National Heating Co., Minneapolis, Minn.
National Mfg. & Engineering Co., Detroit, Mich.
New York Blower Co., Chicago, Ill.
Palmer Mfg. Corp., Phoenix, Ariz.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Rosebraugh Co., W. W., Salem, Ore.
Sonner Burner Co., Winfield, Kans.
XXth Century Heating & Ventilating Co., Akron, O
Vacuum Gas Appliances Div., The Union Fork & Hoe Co., Rome, N. Y.
Western Furnaces, Inc., Tacoma, Wash.
●Zink Co., John, Tulsa, Okla.

GAGE GLASSES

See Glasses, Gage

GAGES, AIR FILTER

Air Filter Engineering Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Dwyer Mfg. Co., F. W., Chicago, Ill.
Ellison Draft Gage Co., Chicago, Ill.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●Hays Corp., Michigan City, Ind.
Herbusch Corp., The, St. Louis, Mo. (Warning device)
Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Meriam Co.. The, Cleveland, O.

GAGES, INDICATING, DRAFT

Ashcroft Gauge Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Dwyer Mfg. Co., F. W., Chicago, Ill.
Ellison Draft Gage Co., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
Hotstream Heater Co., Cleveland, O.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Meriam Co., The, Cleveland, O.
Moeller Instrument Co., Richmond Hill, N. Y.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Preferred Utilities Mfg. Co., New York, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Spence Engrg. Co., Inc., Walden, N. Y.
Uehling Instrument Co., Paterson, N. J.

GAGES, INDICATING, PRESSURE

Ashcroft Gauge Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Belfield Co., H., Philadelphia, Pa.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
●Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Lonergan Co., J. E., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Meriam Co., The, Cleveland, O.
Moeller Instrument Co., Richmond Hill, N. Y.
Mouat Vapor Heating Co., The, Cleveland, O.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Preferred Utilities Mfg. Corp., New York, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Rochester Mfg. Co., Rochester, N. Y.
Scientific Instrument Co., Detroit, Mich.
●Taylor Instrument Companies, Rochester, N. Y.
●Trane Co., La Crosse, Wis.
Triplex Heating Specialty Co., Peru, Ind.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.
Wheelco Instruments Co., Chicago, Ill.

GAGES, INDICATING, VACUUM

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Belfield Co., H., Philadelphia, Pa.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
●Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Lonergan Co., J. E., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Meriam Co., The, Cleveland, O.
Moeller Instrument Co., Richmond Hill, N. Y.
Mouat Vapor Heating Co., The, Cleveland, O.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Preferred Utilities Mfg. Corp., New York, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Rochester Mfg. Co., Rochester, N. Y.
Scientific Instrument Co., Detroit, Mich.
●Taylor Instrument Companies, Rochester, N. Y.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.

GAGES, LIQUID LEVEL

Alloy Steel Products Co., Linden, N. J.
American Injector Co., Detroit, Mich.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
Boston Auto Gage Co., Pittsfield, Mass.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Caldwell Co., W. E., Louisville, Ky.
Defender Automatic Regulator Co., St. Louis, Mo.
●Detroit Lubricator Co., Detroit, Mich.
Diamond Power Specialty Corp., Detroit, Mich.
Foxboro Co.. Foxboro, Mass.
●Frick Co., Waynesboro, Pa.
Hanlon-Waters, Inc., Tulsa, Okla.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Keckley Co., O. C., Chicago, Ill.
King Engineering Corp., Ann Arbor, Mich.
Klingerit, Inc., New York, N. Y.
Liquidometer Corp., Long Island City, N. Y.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Nason Co., Detroit, Mich.
Penberthy Injector Co., Detroit, Mich.
Petrometer Corp., Long Island City, N. Y.
Powell Co., Wm., Cincinnati, O.
Reliance Gauge Column Co., Cleveland, O.
Republic Flow Meters Co., Chicago, Ill.
Rochester Mfg. Co., Rochester, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Scientific Instrument Co., Detroit, Mich.
●Taylor Instrument Companies, Rochester, N. Y.
U-C Level Indicator Sales, Div. of Marketing, Inc., Milwaukee, Wis. (For 55 gal drums)
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.
Viking Pump Co., Cedar Falls, Ia.
Williams Gauge Co., Pittsburgh, Pa. (Water)
Wright-Austin Co., Detroit, Mich.
●Yarnall-Waring Co., Philadelphia, Pa.

GALVANIZED SHEETS

See Sheets, Steel, Galvanized

● Advertisement in this issue. See Index to Advertisers, page 326.

GALVANNEALED SHEETS
See Sheets, Steel, Galvannealed

GAS BURNERS
See Burners, Gas

GAS ENGINES
See Engines, Gas

GAS PRESSURE REGULATORS
See Regulators, Pressure, Gas

GASKETS
Akron Metallic Gasket Co., Akron, O. (Metal & metal asbestos)
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
Anchor Packing Co., Philadelphia, Pa. (Asbestos)
Armstrong Cork Co., Lancaster, Pa. (Cork & cork composition)
Azor Corp., Newark, N. J. (Spiral wound)
Belmont Smelting & Refining Works, Inc., Brooklyn, N. Y. (Lead)
Butterworth, Jr., B. T., New Canaan, Conn. (Cork)
Chicago-Wilcox Mfg. Co., Chicago, Ill.
Clow & Sons, James B., Chicago, Ill.
Continental Diamond Fibre Co., Newark, Del.
Continental Rubber Wks., Erie, Pa.
Crane Co., Chicago, Ill.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc. New York, N. Y. (Asbestos)
Durabla Mfg. Co., New York, N. Y. (Asbestos fibre)
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Endura Mfg. Corp., Quakertown, Pa. (Paper, fibre)
Excelsior Leather Washer Mfg. Co., Rockford, Ill.
Felt Products Mfg. Co. Chicago, Ill. (Heat and oil resisting)
Felters Co., Inc., Boston, Mass.
Flexatalic Gasket Co., Camden, N. J. (Metal, asbestos)
Flexlock Corp., Akron, O.
●Frick Co., Waynesboro, Pa.
Garlock Packing Co., Palmyra, N. Y. (Rubber, asbestos, fibre, semi-metallic)
Gatke Corp., Chicago, Ill.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
●Grant Wilson, Inc., Chicago, Ill. (Asbestos)
Graton & Knight Co., Worcester, Mass. (Leather)
Houghton & Co., E. F., Philadelphia, Pa. (Leather)
●Jenkins Bros., New York, N. Y. (Ring asbestos or rubber sheet)
●Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
Klingerit, Inc., New York, N. Y.
Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
Manhattan Rubber Mfg., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Metallo Gasket Co., New Brunswick, N. J. (Metal, metal asbestos)
Miller Rubber Co., Inc., Akron, O.
Mitchell & Smith, Inc., Detroit, Mich. (Cork)
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Quaker Rubber Corp., Philadelphia, Pa.
Resistoflex Corp., Belleville, N. J. (Synthetic resin)
Ruberoid Co., New York, N. Y. (Asbestos)
Schieren Co., Chas. A., New York, N. Y.
Smooth-On Mfg. Co., Jersey City, N. J. (Corrugated iron)
Steel Improvement & Forge Co., Cleveland, O.
Stokes Rubber Co., Jos., Trenton, N. J. (Hard rubber)
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
Union Asbestos & Rubber Co., Cicero, Ill.
United States Rubber Co., New York, N. Y. (Rubber, asbestos)
●Western Felt Wks., Chicago, Ill. (Felt)
●Wilson, Inc., Grant, Chicago, Ill. (Asbestos)

GATE VALVES
See Valves, Gate

GATES, BLAST
●Airtherm Mfg Co. St. Louis, Mo.
Allington & Curtis Mfg. Co., Saginaw, Mich.
Berger Bros. Co., Philadelphia, Pa.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
●Clarage Fan Co., Kalamazoo, Mich.
●Day Co., The, Minneapolis, Minn.
Goethel Co., Alfred C., Milwaukee, Wis.
Goethel Sheet Metal Works, Alfred, Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Kirk & Blum Mfg. Co., Cincinnati, O.
Maysteel Products, Inc., Mayville, Wis.
Puhl & Hepper Mfg. Co., Inc., St. Louis, Mo.
R-S Products Corp., Philadelphia, Pa.
Spencer Turbine Co., Hartford, Conn.
●Sturtevant Co., B. F., Boston, Mass.
Western Blower Co., Seattle, Wash.

GLASS PIPE
See Pipe, Glass

GLASSES, GAGE
Bache, Semon & Co., New York, N. Y.
Corning Glass Works, Corning, N. Y.
Crane Co., Chicago, Ill.
Durabla Mfg. Co., New York, N. Y.
●Jenkins Bros., New York, N. Y.
Klingerit, Inc., New York, N. Y.
Powell Co., Wm., Cincinnati, O.

GLASSES, SIGHT, FOR PIPE LINES
●Cochrane Corp., Philadelphia, Pa.
Corning Glass Works, Corning, N. Y.

GLOBE VALVES
See Valves, Globe

GOVERNORS, PUMP
Atlas Valve Co., Inc., Newark, N. J.
Boylston Steam Specialty Co., Chicago, Ill.
Burrows Mfg. Co., F. A., York, Pa.
●Cash Co., A. W., Decatur, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Gardner-Denver Co., Quincy, Ill.
Hagan Corp., Pittsburgh, Pa.
Hanlon-Waters, Inc., Tulsa, Okla.
●Illinois Engineering Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Northern Equipment Co., Erie, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Squires Co., C. E., Cleveland, O.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

GRILLES
Air Control Products, Inc., Muskegon, Mich.
Air Devices, Inc., New York, N. Y.
AirO-Fin Register Co., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American Warming & Ventilating Co., Toledo, O.
●Auer Register Co., Cleveland, O.
●Barber-Colman Co., Rockford, Ill.
Beckley Perforating Co., Garwood, N. J.
Best Register Co., Milwaukee, Wis.
Central Wire & Iron Works, Des Moines, Ia.
Char-Gale Mfg. Co., Minneapolis, Minn.
Cross Engineering Co., Carbondale, Pa.
Crown Iron Works, Minneapolis, Minn.
Decatur Iron & Steel Co., Decatur, Ala.
Diamond Mfg. Co., Wyoming, Pa.
Erdle Perforating Co., Rochester, N. Y.
Gillian Mfg. Co., Detroit, Mich.
Harrington & King Perforating Co., Chicago, Ill.
Hart & Cooley Mfg. Co., Holland, Mich.
Hendrick Mfg. Co., Carbondale, Pa.
●Independent Register Co., Cleveland, O.
Jamieson Mfg. Co., Dallas, Tex.
Johnston & Chapman Co., Chicago, Ill.
Lamneck Products, Inc., Middletown, O.
Lockjoint Wood Products Co., Wichita, Kans. (Wood)
Manhattan Perforated Metal Co., Inc., Long Island City, N. Y.
Metalace Corp., So. Boston, Mass.
●Mueller Furnace Co., L. J., Milwaukee, Wis.
Mundt & Sons, Charles, Jersey City, N. J.
Newman Brothers, Inc., Cincinnati, O.
●Register & Grille Mfg. Co., Brooklyn, N. Y.
Reliable Perforating Co., Chicago, Ill.
Roberts-Hamilton Co., Minneapolis, Minn.
Rock Island Register Co., Rock Island, Ill.
Schoedinger, F. O., Columbus, O.
Standard Stamping & Perforating Co., Chicago, Ill.
●Trane Co., La Crosse, Wis.
●Tuttle & Bailey, Inc., New Britain, Conn.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
United States Register Co., Battle Creek, Mich.
Utility Fan Corp., Los Angeles, Cal.
Waterloo Register Co., Waterloo, Ia.

● Advertisement in this issue. See Index to Advertisers, page 326.

Western Wire & Iron Works, Inc., Chicago, Ill.
Wickwire Spencer Steel Co., New York, N. Y.
Wooster Art Wood, Inc., Wooster, O.

GUNS AND POTS, SMOKE AND SMUDGE, FOR TESTING AIR MOVEMENT

Hill, E. Vernon, Chicago, Ill.
Newman Co., Inc., I. C., New York, N. Y.
Pains Fireworks Display Co., New York, N. Y.

HAND SHEARS

See Shears and Snips, Hand

HANGERS OR BRACKETS, RADIATOR

American Foundry & Furnace Co., Bloomington, Ill.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Carpenter & Paterson, Inc., East Boston, Mass.
Carty & Moore Engineering Co., Detroit, Mich.
Chicago Nipple Mfg. Co., Chicago, Ill.
Crane Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Hartmann Co., Chas., Brooklyn, N. Y.
Healy Ruff Co., St. Paul, Minn.
Inland Mfg. Co., Chicago, Ill. (Unit heater hangers)
Jennison Co., Fitchburg, Mass. (Adjustable radiator foot rest)
Logansport Radiator Equipment Co., Logansport, Ind.
●McAlear Mfg. Co., Chicago, Ill.
National Radiator Co., The, Johnstown, Pa.
Paine Co., Chicago, Ill.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
United States Radiator Corp., Detroit, Mich.
Western Hanger Co., San Francisco, Cal.

HANGERS AND SUPPORTS, PIPE

●American District Steam Co., North Tonawanda, N. Y.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Carpenter & Paterson, Inc., East Boston, Mass.
Chicago Nipple Mfg. Co., Chicago, Ill.
Crane Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Farley Sleeve & Hanger Co., Cleveland, O.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
●Frick Co., Waynesboro, Pa.
Globe Machine & Stamping Co., Cleveland, O.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Valve & Mfg. Co., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
Ravena Iron Co., Ravena, N. Y.
●Reznor Mfg. Co., Mercer, Pa.
●Ric-wiL Co., Cleveland, O. (Underground)
Rockwood Sprinkler Co., Worcester, Mass.
Roessing Mfg. Co., Pittsburgh, Pa.
Semler Co., Jeannette, Pa.
Truscon Steel Co., Youngstown, O.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburg, Pa.
Western Wire Products Co., St. Louis, Mo.

HARD RUBBER PIPE

See Pipe, Hard Rubber

HEADERS, WELDED

Acme Industries, Inc., Jackson, Mich.
American Locomotive Co., Alco Products Div., New York, N. Y.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Biggs Boiler Works Co., E. Akron, O.
Chicago Nipple Mfg. Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Crane Co., Chicago, Ill.
●Downingtown Iron Works, Downingtown, Pa.
●Frick Co., Waynesboro, Pa.
●Grinnell Co., Inc., Providence, R. I.
International Engineering Wks., Inc., Framingham, Mass.
Kellogg Co., M. W., The, New York, N. Y.
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden & Van Stone Co., South Boston, Mass.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Pipe Bending Co., New Haven, Conn.
National Valve & Mfg. Co., Pittsburgh, Pa.
Naylor Pipe Co., Chicago, Ill.
Ohio Pipe Bending & Mach. Co., Cleveland, O.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
Pittsburgh Pipe Coil & Bending Co., Etna, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
Rempe Co., Chicago, Ill.
Richmond Engineering Co., Inc., Richmond, Va.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Semet-Solvay Engineering Corp., New York, N. Y.
Shaw Co., Benjamin F., Wilmington, Del.
Shaw-Kendall Engineering Co., Toledo, O.
Walworth Co., New York, N. Y.
Zallea Brothers & Johnson, Wilmington, Del.

HEADS, EXHAUST, FOR PIPE LINES

●Cochrane Corp., Philadelphia, Pa.
Hoppes Mfg. Co., Springfield, O.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Wright-Austin Co., Detroit, Mich.

HEADS, SPRINKLER

●Binks Mfg. Co., Chicago, Ill.
Cleghorn Co., Boston, Mass.
●Grinnell Co., Inc., Providence, R. I.
Hodgman Mfg. Co., Taunton, Mass.
Northern Indiana Brass Co., Elkhart, Ind.
Raisler Corp., Grimes Sprinkler Div., New York, N. Y.
Rockwood Sprinkler Co., Worcester, Mass.

HEAT EXCHANGERS

See Chillers, Water; Condensers, Refrigerating; Surface, Cooling; Surface, Heating

HEATERS, AIR, DIRECT FIRED

Air Devices, Inc., New York, N. Y.
●Airtherm Mfg. Co., St. Louis, Mo.
American Furnace Co., St. Louis, Mo.
Campbell Heating Co., Des Moines, Ia.
Century Engineering Corp., Cedar Rapids, Ia.
Despatch Oven Co., Minneapolis, Minn.
Dravo Corp., Pittsburgh, Pa.
Faraday Engineering Co., Boston, Mass.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Jackson & Church Co., Saginaw, Mich.
Lee Engineering Co., Youngstown, O.
Magirl Foundry & Furnace Wks., P. H., Bloomington, Ill.
McCann Furnace Co., Cleveland, O.
National Heating Co., Minneapolis, Minn.
National Mfg. & Engineering Co., Detroit, Mich.
Nelson Co., Detroit, Mich.
New York Blower Co., Chicago, Ill.
Pacific Gas Radiator Co., Huntington Park, Cal.
Palmer Mfg. Corp., Phoenix, Ariz.
Ross Engineering Corp., J. O., New York, N. Y.
Smith, Inc., James Campbell, Cleveland, O.
Sonner Burner Co., Winfield, Kans.
Supreme Heater & Ventilating Corp., St. Louis, Mo.
●Surface Combustion Corp., Toledo, O.
Thermal Engineering Associates, Chicago, Ill.
Williams, Inc., F. C., Dearborn, Mich.

HEATERS, DUCT, ELECTRIC

Consolidated Car-Heating Co., Inc., Albany, N. Y.
Despatch Oven Co., Minneapolis, Minn.
●General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Camden, N. J.
Tenney Engineering, Inc., Bloomfield, N. J.
Trent Co., Harold E., Philadelphia, Pa.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, DUCT, GAS

Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
●Bryant Heater Co., The, Cleveland, O.
Carrier Corp., Syracuse, N. Y.
Pacific Gas Radiator Co., Huntington Park, Cal.
Palmer Mfg. Corp., Phoenix, Ariz.
●Reznor Mfg. Co., Mercer, Pa.
Royal Air Conditioning Equipment Co., Alhambra, Cal.
●Trane Co., La Crosse Wis.
Utility Fan Corp., Los Angeles, Cal.
Vacuum Gas Appliances Div., The Union Fork & Hoe Co., Rome, N. Y.

HEATERS, INDIRECT, SUBMERGED

●Bell & Gossett Co., Morton Grove, Ill.
Taco Heaters, Inc., New York, N. Y.

HEATERS, STRIP AND IMMERSION, ELECTRIC

American Instrument Co., Silver Spring, Md.
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Cutler-Hammer, Inc., Milwaukee, Wis.
●General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Camden, N. J.
Purdue Associates, Inc., Albert G., New Haven, Conn. (Electric pipe line heaters)
Red Spot Electric Co., Tacoma, Wash.
Swoboda, Inc., H. O., New Brighton, Pa.
Trent Co., Harold E., Philadelphia, Pa.
Vulcan Electric Co., Danvers, Mass.
Westinghouse Electric & Mfg. Co., Mansfield, O.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, UNIT, ELECTRIC HEATING ELEMENT

●Burnham Boiler Corp., Irvington, N. Y. (Radiator)
Consolidated Car-Heating Co., Inc., Albany, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 326.

Electric Air Heater Co., Div. American Foundry Equipment Co., Mishawaka, Ind.
●General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Camden, N. J.
●Ilg Electric Ventilating Co., Chicago, Ill.
Red Spot Electric Co., Tacoma, Wash.
Samson-United Corp., Rochester, N. Y.
Tenney Engineering, Inc., Bloomfield, N. J.
Trent Co., Harold E., Philadelphia, Pa.
Vulcan Electric Co., Danvers, Mass.
Warren Electric Appliance Co., Warren, Pa.
Westinghouse Electric & Mfg. Co., Mansfield, O.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, UNIT, GAS FIRED

Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Automatic Gas Equipment Co., Pittsburgh, Pa.
●Bryant Heater Co, The, Cleveland, O.
Campbell Heating Co., E. K., Kansas City, Mo.
Carrier Corp., Syracuse, N. Y.
Clow & Sons, James B., Chicago, Ill.
Continental Stove Corp., Ironton, O.
General Gas Light Co., Kalamazoo, Mich.
●Ilg Electric Ventilating Co., Chicago, Ill.
McCann Furnace Co., Cleveland, O.
●McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
●Mueller Furnace Co., L. J., Milwaukee, Wis.
Pacific Gas Radiator Co., Huntington Park, Cal.
Palmer Mfg. Corp., Phoenix, Ariz.
●Reznor Mfg. Co., Mercer, Pa.
●Surface Combustion Corp., Toledo, O.
●Trane Co., La Crosse, Wis.
Utility Fan Corp., Los Angeles, Cal.
Vacuum Gas Appliances Div., The Union Fork & Hoe Co., Rome, N. Y.

HEATERS, UNIT, STEAM AND HOT WATER

●Airtherm Mfg. Co., St. Louis, Mo.
American Blower Corp., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Beacon-Morris Corp., Boston, Mass.
Berns Specialty Co., Chicago, Ill.
●Bishop & Babcock Mfg. Co., Cleveland, O.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
●Burnham Boiler Corp., Irvington, N. Y.
Campbell Heating Co., E. K., Kansas City, Mo.
Carrier Corp., Syracuse, N. Y.
Champion Unit Heater Co., Chicago, Ill.
●Clarage Fan Co., Kalamazoo, Mich.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Dunham Co., C. A., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●Grinnell Co., Inc., Providence, R. I.
Hartzell Propeller Fan Co., Piqua, O.
Harvey-Whipple, Inc., Springfield, Mass.
Hastings Air Conditioning Co., Hastings, Neb.
●Ilg Electric Ventilating Co., Chicago, Ill.
Industrial Mfg. & Engrg. Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Johnson Fan & Blower Corp., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Kisco Co., Inc., St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
●McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Murray Iron Wks. Co., Burlington, Ia.
●Murray Mfg. Co., D. J., Wausau, Wis.
National Radiator Co., The, Johnstown, Pa.
Nelson Corp., Herman, Moline, Ill.
●Nesbitt, Inc., John J., Philadelphia, Pa.
New York Blower Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Richmond Engineering Co., Inc., Richmond, Va.
Rome-Turney Radiator Co., Rome, N. Y.
Ross Engineering Corp., J. O., New York, N. Y.
Semco Mfg. Co., Nashville, Tenn.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
●Sturtevant Co., B. F., Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Tenney Engineering, Inc., Bloomfield, N. J.
●Trane Co., La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
●Webster & Co., Warren, Camden, N. J.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.
●Young Radiator Co., Racine, Wis.

HEATERS, WATER, CAST IRON, COAL FIRED

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Burnham Boiler Corp., Irvington, N. Y.
Cleghorn Co., Boston, Mass.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Glore Sales Corp., Evins F., New York, N. Y.
International Heater Co., Utica, N. Y.
National Radiator Co., The, Johnstown, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Inc., Frank, Terre Haute, Ind.
Schwitzer-Cummins Co., Indianapolis, Ind.
Smith Co., Inc., H. B., The, Westfield, Mass.
Spencer Heater Div., Aviation Mfg. Corp., Williamsport, Pa.
Thatcher Furnace Co., Newark, N. J.
Weil-McLain Co., Chicago, Ill.

HEATERS, WATER, ELECTRIC

●Bell & Gossett Co., Morton Grove, Ill.
Hotstream Heater Co., Cleveland, O.
Hynes Electric Heating Co., Camden, N. J.
Westinghouse Electric & Mfg. Co., Mansfield, O.

HEATERS, WATER, GAS FIRED

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Bryant Heater Co., The, Cleveland, O.
●Dunham Co., C. A., Chicago, Ill.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Gerstein & Cooper Co., South Boston, Mass.
Handley Brown Heater Co., Jackson, Mich.
Hotstream Heater Co., Cleveland, O.
International Engineering Wks., Inc., Framingham, Mass.
Johnson Co., S. T., Oakland, Cal.
Montgomery Bros., San Francisco, Cal.
●Mueller Furnace Co., L. J., Milwaukee, Wis.
National Radiator Co., The, Johnstown, Pa.
Pacific Gas Radiator Co., Huntington Park, Cal.
Pittsburgh Water Heater Co., Pittsburgh, Pa.
Richmond Radiator Co., Uniontown, Pa.
Rotary Mfg. Co., Los Angeles, Cal.
Ruud Mfg. Co., Pittsburgh, Pa.
Sonner Burner Co., Winfield, Kans.
United States Radiator Corp., Detroit, Mich.

HEATERS, WATER, INDIRECT

Akwa Heaters, Inc., New York, N. Y.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Bell & Gossett Co., Morton Grove, Ill.
Bryan Steam Corp., Peru, Ind.
Davis Engineering Corp., Elizabeth, N. J.
●Downingtown Iron Works, Downingtown, Pa.
Ferguson & Lange Foundry Co., Chicago, Ill.
General Fittings Co., Providence, R. I.
Hotstream Heater Co., Cleveland, O.
Kehm Corp., The, Chicago, Ill.
Little Mfg. Co., M. S., Hartford, Conn.
Marion Machine Foundry & Supply Co., Marion, Ind.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Richmond Engineering Co., Inc., Richmond, Va.
Sims Co., Erie, Pa.
Standard Heater & Oil Equipment Co., Jersey City, N. J.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
Triplex Heating Specialty Co., Peru, Ind.
Vapor Car Heating Co., Inc., Chicago, Ill.

HEATERS, WATER, INDIRECT, COMBINATION TANK AND TANKLESS

●Bell & Gossett Co., Morton Grove, Ill.

HEATERS, WATER, OIL FIRED

Aeroil Burner Co., Inc., West New York, N. J.
Air Devices, Inc., New York, N. Y.
Bethlehem Foundry & Machine Co., Bethlehem, Pa.
Cleaver-Brooks Co., Milwaukee, Wis.
Delco Appliance Co., Rochester, N. Y.
Eastern Oil & Equipment Co., Inc., Portland, Me.
Electrol, Inc., Clifton, N. J.
Gerstein & Cooper Co., South Boston, Mass.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Glore Sales Corp., Evins F., New York, N. Y.
Hotstream Heater Co., Cleveland, O.
International Engineering Wks., Inc., Framingham, Mass
Johnson Co., S. T., Oakland, Cal.
Littleford Bros., Cincinnati, O.
Nu-Way Corp., Rock Island, Ill.
Pacific Steel Boiler Div., United States Radiator Corp., Detroit, Mich.
●Petroleum Heat & Power Co, Stamford, Conn.
Preferred Utilities Mfg. Corp., New York, N. Y.
Ray Oil Burner Co., San Francisco, Cal.
Reif-Rexoil, Inc., Buffalo, N. Y.
Scott-Newcomb, Inc., St. Louis, Mo.
Smith Co., Inc., H. B., The, Westfield, Mass.
Spencer Heater Div., Aviation Mfg. Corp., Williamsport, Pa.
United States Radiator Corp., Detroit, Mich.
Vapor Car Heating Co., Inc., Chicago, Ill.
Wayne Oil Burner Corp., Fort Wayne, Ind.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
York Oil Burner Co., Inc., York, Pa.

HEATERS, WATER, STEAM, INSTANTANEOUS

Akwa Heaters, Inc., New York, N. Y.
●American District Steam Co., North Tonawanda, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 326.

American Locomotive Co., Alco Products Div., New York, N. Y.
●Bell & Gossett Co., Morton Grove, Ill.
Croli-Reynolds Engineering Co., Inc., New York, N. Y.
Davis Engineering Corp., Elizabeth, N. J.
●Downingtown Iron Works, Downingtown, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Frank Heaters, Inc., Paterson, N. J.
General Fittings Co., Providence, R. I.
General Furnaces Corp., New York, N. Y.
Gerstein & Cooper Co., South Boston, Mass.
Griscom-Russell Co., The, New York, N. Y.
Hasco Valve & Machine Co., Milwaukee, Wis.
Heat Transfer Products, Inc., New York, N. Y.
Howard Iron Wks. & Alberger Heater Co., Buffalo, N. Y.
Johnson Corp., Three Rivers, Mich.
Marion Machine Foundry & Supply Co., Marion, Ind.
Montgomery Bros., San Francisco, Cal.
National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Quaker City Iron Works, Philadelphia, Pa.
Richmond Engineering Co., Inc., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sims Co., Erie, Pa.
Standard Heater & Oil Equipment Co., Jersey City, N. J.
Super Radiator Corp., Minneapolis, Minn.
Swartwout Co., Cleveland, O.
Taco Heaters, Inc., New York, N. Y.
Watts Regulator Co., Lawrence, Mass.
●Whitlock Mfg. Co., Hartford, Conn.
Zallea Brothers & Johnson, Wilmington, Del.

HEATERS, WATER, STEAM, STORAGE

Akwa Heaters, Inc., New York, N. Y.
●American District Steam Co., North Tonawanda, N. Y.
●Bell & Gossett Co., Morton Grove, Ill.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
●Burnham Boiler Corp., Irvington, N. Y.
Davis Engineering Co., Elizabeth, N. J.
●Downingtown Iron Works, Downingtown, Pa.
Frank Heaters, Inc., Paterson, N. J.
General Fittings Co., Providence, R. I.
Gerstein & Cooper Co., South Boston, Mass.
Griscom-Russell Co., The, New York, N. Y.
Heat Transfer Products, Inc., New York, N. Y.
Howard Iron Wks. & Alberger Heater Co., Buffalo, N. Y.
International Engineering Wks., Inc., Framingham, Mass.
Johnson Corp., Three Rivers, Mich.
●Kewanee Boiler Corp., Kewanee, Ill.
Koven & Bro., Inc., L. O., Jersey City, N. J.
Manitowoc Boiler Wks., Manitowoc, Wis.
Marion Machine Foundry & Supply Co., Marion, Ind.
Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Quaker City Iron Works, Philadelphia, Pa.
Richmond Engineering Co., Inc., Richmond, Va.
Rotary Mfg. Co., Los Angeles, Cal.
Sims Co., Erie, Pa.
Standard Heater & Oil Equipment Co., Jersey City, N. J.
Super Radiator Corp., Minneapolis, Minn.
Vogt Machine Co., Henry, Louisville, Ky.
Warren Electric Appliance Co., Warren, Pa. (Electric)
Waterfilm Boilers, Inc., Jersey City, N. J.
●Whitlock Mfg. Co., Hartford, Conn.

HEATERS, WATER, STEEL, COAL FIRED

Aeroil Burner Co., Inc., West New York, N. J.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
●Fitzgibbons Boiler Co., New York, N. Y.
International Engineering Wks., Inc., Framingham, Mass.
Johnson Bros., Inc., Ferrysburg, Mich.
●Kewanee Boiler Corp., Kewanee, Ill.
Lookout Boiler & Mfg. Co., Chattanooga, Tenn.
National Radiator Co., The, Johnstown, Pa.
Pacific Steel Boiler Div., United States Radiator Corp., Detroit, Mich.
Spencer Heater Div., Aviation Mfg. Corp., Williamsport, Pa.

HEATING BOILERS

See Boilers, Heating

HEATING COILS

See Surface, Heating

HEATING SURFACE

See Surface, Heating

HOSE, METAL, FOR ELIMINATING COMPRESSOR VIBRATION

American Metal Hose Branch, American Brass Co., Waterbury, Conn.
Atlantic Metal Hose Co., Inc., New York, N. Y.
Bendix Aviation Corp., Philadelphia Div., Philadelphia, Pa.
Chicago Metal Hose Corp., Maywood, Ill.
Conklin Brass & Copper Co., Inc., T. E., New York, N. Y.
Packless Metal Products Corp., New Rochelle, N. Y.
Pennsylvania Flexible Metallic Tubing Co., Philadelphia, Pa.
Seamlex Co., Inc., Long Island City, N. Y.
Titeflex Metal Hose Co., Newark, N. J.
United Metal Hose Co., Inc., Long Island City, N. Y

HOT WATER HEATING SYSTEMS

See Systems, Heating, Hot Water

HOT WATER PRESSURE REGULATORS

See Regulators, Pressure, Hot Water Heating Systems

HOUSINGS, FAN, CENTRIFUGAL

Air Controls, Inc., Cleveland, O.
Brundage Co., The, Kalamazoo, Mich.
●Clarage Fan Co., Kalamazoo, Mich.
●Commercial Shearing & Stamping Co., Youngstown, O.
●Detroit Stamping Co., Detroit, Mich.
Economy Electric Mfg. Co., Chicago, Ill.
General Blower Corp., San Francisco, Cal.
Hastings Air Conditioning Co., Inc., Hastings, Nebr.
Lau Blower Co., Dayton, O.
National Mfg. & Engineering Co., Detroit, Mich.
Sandberg Sheet Metal Works, Portland, Ore.
Schwitzer-Cummins Co., Indianapolis, Ind.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Viking Air Conditioning Corp., Cleveland, O.

HOUSINGS, FAN, PROPELLER

●Commercial Shearing & Stamping Co., Youngstown, O.

HUMIDIFIERS, CENTRAL PLANT

●Air & Refrigeration Corp., New York, N. Y.
American Blower Corp., Detroit, Mich.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Armstrong Machine Wks., Three Rivers, Mich.
●Barber-Colman Co., Rockford, Ill.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
●Johnson Service Co., Milwaukee, Wis.
Mellish & Murray Co., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monmouth Products Co., Cleveland, O.
Parks-Cramer Co., Fitchburg, Mass.
●Powers Regulator Co., Chicago, Ill.
Research Corp., New York, N. Y.
Ross Engineering Corp., J. O., New York, N. Y.
Southworth Machine Co., Portland, Me.
Spray-Wheel Air Conditioners, Inc., Denver, Colo.
Steamaire Co., Cincinnati, O.
Strandwitz & Co., Inc., W. J., Camden, N. J.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●Surface Combustion Corp., Toledo, O.
●Trane Co., La Crosse, Wis.

HUMIDIFIERS, DIRECT, SPRAY HEAD

●Air & Refrigeration Corp., New York, N. Y.
American Moistening Co., Providence, R. I.
Anetsberger Bros., Chicago, Ill.
Bahnson Co., Winston-Salem, N. C.
Betz Air Conditioning Corp., Kansas City, Mo.
●Binks Mfg. Co., Chicago, Ill.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Chelsea Fan & Blower Co., Irvington, N. J.
International Moistening Co., Providence, R. I.
Lohman Co., Wm. J., Irvington, N. J.
Manufacturers Machine Co., North Andover, Mass.
●Marley Co., Kansas City, Kans.
Mellish & Murray Co., Chicago, Ill.
●Murray Mfg. Co., D. J., Wausau, Wis.
New York Blower Co., Chicago, Ill.
Parks-Cramer Co., Fitchburg, Mass.
Pfening Co., Fred D., Columbus, O.
Rhode Island Humidifier & Ventilating Co., Boston, Mass.
Ross Sprinkler Co., Pasadena, Cal.
●Somers, Inc., H. J., Detroit, Mich.
Southworth Machine Co., Portland, Me.
Spray Engineering Co., Somerville, Mass.
●Spraying Systems Co., Chicago, Ill.
Steamaire Co., Cincinnati, O.
Supreme Electric Products Corp., Rochester, N. Y.
Utility Fan Corp., Los Angeles, Cal.

HUMIDIFIERS FOR RADIATORS AND CONVECTORS

Lowell Air Conditioning Corp., Philadelphia, Pa.
●Maid-O'-Mist, Inc., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Russell & Co., W. A., Bridgeport, Conn.
Skilbeck Mfg. Co., Kenosha, Wis.

HUMIDIFIERS, RADIATOR VENT VALVE

●Maid-O'-Mist, Inc., Chicago, Ill.
Skilbeck Mfg. Co., Kenosha, Wis.

HUMIDIFIERS, UNIT, ROOM TYPE (Without Heating)

Alter Co., Harry, Chicago, Ill.
Betz Air Conditioning Corp., Kansas City, Mo.
Carrier Corp., Syracuse, N. Y.
Certified Products Co., Toledo, O.
Comfort Products Corp., Harvey, Ill.
Coolmaster Corp., Chicago, Ill.

● Advertisement in this issue. See Index to Advertisers, page 326.

Coroaire Heater Corp., The, Cleveland, O.
Cugley Incubator Co., Elkhart, Ind.
Fairbanks, Morse & Co., Chicago, Ill.
Hugo Mfg. Co., Duluth, Minn.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Lion Mfg. Corp., Chicago, Ill.
Little Giant Vaporizer Co., Oklahoma City, Okla.
●Murray Mfg. Co., D. J., Wausau, Wis.
Norwood Filtration Co., The, Florence, Mass.
Skilbeck Mfg. Co., Kenosha, Wis.
●Somers, Inc., H. J., Detroit, Mich.
Southworth Machine Co., Portland, Me.
Spray-Wheel Air Conditioners, Inc., Denver, Colo.
Standard Engineering Wks., Pawtucket, R. I.
Steamaire Co., Cincinnati, O.
●U. S. Air Conditioning Corp., Minneapolis, Minn.

HUMIDIFYING RADIATORS

See Radiators, Humidifying

HUMIDISTATS

American Moistening Co., Providence, R. I.
Au-Temp-Co Corp., New York, N. Y.
Bahnson Co., Winston-Salem, N. C.
●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
●Detroit Lubricator Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
H-B Instrument Co., Philadelphia, Pa.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Parks-Cramer Co., Fitchburg, Mass.
Penn Electric Switch Co., Goshen, Ind.
●Powers Regulator Co., Chicago, Ill.
Spencer Thermostat Co., Attleboro, Mass.
Standard Engineering Wks., Pawtucket, R. I.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
●White-Rodgers Electric Co., St. Louis, Mo.

HUMIDITY RECORDERS

See Recorders, Humidity

HUMIDITY AND TEMPERATURE CONTROLS

See Humidistats; Recorder-Controllers; Thermostats

HYDRAULIC SPEED CHANGERS

See Changers, Speed, Hydraulic Coupling

HYGROMETERS

American Moistening Co., Providence, R. I.
American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bahnson Co., Winston-Salem, N. C.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Fee and Stemwedel, Inc., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hill, E. Vernon, Chicago, Ill.
International Moistening Co., Providence, R. I.
●Johnson Service Co., Milwaukee, Wis.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Parks-Cramer Co., Fitchburg, Mass.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Rochester Mfg. Co., Rochester, N. Y.
Scientific Instrument Co., Detroit, Mich.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Weksler Thermometer Corp., New York, N. Y.

HYGROSTATS

See Humidistats

IMMERSION THERMOSTATS

See Thermostats, Immersion

INDICATING THERMOMETERS

See Thermometers, Indicating

INDICATOR-CONTROLLERS, PRESSURE

Bailey Meter Co., Cleveland, O.
Bristol Co., The, Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Foxboro Co., Foxboro, Mass.
Hanlon-Waters, Inc., Tulsa, Okla.
Mason-Neilan Regulator Co., Boston, Mass.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Wheelco Instruments Co., Chicago, Ill.

INDICATOR-CONTROLLERS, RELATIVE HUMIDITY

Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

INDICATOR-CONTROLLERS, TEMPERATURE

Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Pyrometer Instrument Co., New York, N. Y.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Wheelco Instruments Co., Chicago, Ill.

INDICATORS, CARBON DIOXIDE, BOILER ROOM

For portable CO_2 analyzers, see Analyzers, Carbon Dioxide, Portable

Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Engelhard, Inc., Chas., Newark, N. J.
●Hays Corp., Michigan City, Ind.
Leeds & Northrup Co., Philadelphia, Pa.
Permutit Co., New York, N. Y.
Weaver Mfg. Co., Springfield, Ill.

INDICATORS, SOUND LEVEL

●General Electric Co., Schenectady, N. Y.

INDIRECT HEATING SURFACE

See Surface, Heating

INDIRECT WATER HEATERS

See Heaters, Water, Indirect

INDUSTRIAL AIR CONDITIONERS

See Units, Air Conditioning, Industrial Type

INSTANTANEOUS WATER HEATERS

See Heaters, Water, Steam, Instantaneous

INSULATION, BOILER AND TANK

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Alfol Insulation Co., Inc., New York, N. Y. (Aluminum foil)
Aluminum Aircell Insulation Co., Detroit, Mich.
Armstrong Cork Co., Lancaster, Pa.
●Baldwin-Hill Co., Trenton, N. J. (Rock wool)
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Botfield Refractories Co., Philadelphia, Pa.
●Carey Mfg. Co., Philip, Lockland, Cincinnati, O.
Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., Inc., New York, N. Y. (Cork)
Eagle-Picher Lead Co., Cincinnati, O.
Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Magnesia)
●Grant Wilson, Inc., Chicago, Ill.
International Vermiculite Co., Springfield, Ill.
Jamar Co., Walker, Duluth, Minn.
●Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y. (Asbestos)
Keasbey & Mattison Co., Ambler, Pa.
Krehbiel Co., J. H., Chicago, Ill.
●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
Munn and Steele, Inc., Newark, N. J.
National Gypsum Co., Buffalo, N. Y. (Rock wool)
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Asbestos and magnesia)
●Owens-Corning Fiberglas Corp., Toledo, O. (Blanket)
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Refractory & Insulation Corp., New York, N. Y. (Blanket, block, cement)
Reynolds Metals Co., Richmond, Va.
Robinson Insulation Co., Great Falls, Mont.
Ruberoid Co., New York, N. Y. (Asbestos, magnesia)
Sall Mountain Co., Chicago, Ill.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Smith & Kanzler Corp., Elizabeth, N. J.
Standard Asbestos Mfg. Co., Chicago, Ill.
Standard Lime and Stone Co., Baltimore, Md. (Rock wool)
Therminsul Corp., Kalamazoo, Mich. (Felted block)
Union Asbestos & Rubber Co., Cicero, Ill.
United Cork Co., Kearney, N. J. (Cork)
Universal Zonolite Insulation Co., Chicago, Ill. (Plastic)
Walker Jamar Co., Duluth, Minn.
●Wilson, Inc., Grant, Chicago, Ill.

● Advertisement in this issue. See Index to Advertisers, page 826.

INSULATION, BUILDING

Acme Asbestos Covering & Flooring Co., Chicago, Ill. (Rock wool)
Air-O-Cel Industries, Inc., Detroit, Mich.
Alfol Insulation Co., New York, N. Y. (Aluminum foil)
Alton Mineral Wool Insulation Co., Alton, Ill.
Aluminum Aircell Insulation Co., Detroit, Mich.
American Flange & Mfg. Co., Inc., New York, N. Y. (Metal sheets)
American Hair & Felt Co., Chicago, Ill. (Hair felt)
Armstrong Cork Co., Lancaster, Pa. (Corkboard, fibreboard)
Bache & Co., Semon, New York, N. Y. (Glass wool)
●Baldwin-Hill Co., Trenton, N. J. (Rock wool)
Barber Asphalt Corp., Barber, N. J.
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Berry, Jr. & Co., Inc., F. E., Boston, Mass.
Butterworth, Jr., B. T., New Canaan, Conn. (Cork)
Cabot, Inc., Samuel, Boston, Mass.(Flexible)
●Carey Mfg Co., Philip, Lockland, Cincinnati, O. (Rock wool)
Carney Rockwool Co., Mankato, Minn.
Celotex Corp., The, Chicago, Ill.
Certain-teed Products Corp., New York, N. Y. (Board, reflective)
Chamberlin Metal Weather Strip Co., Detroit, Mich. (Rock wool)
Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., Inc., New York, N. Y. (Corkboard)
Doheny Co., John J., Belmont, Mass. (Blanket)
Dry-Zero Corp., Chicago, Ill.
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool, blankets, batts, granulated, loose)
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Fir-Tex Insulating Board Co., St. Helens, Ore. (Wood fibreboard)
Flintkote Co., New York, N. Y. (Fiber board and rock wool)
General Insulating Products Co., Brooklyn, N. Y. (Rock wool)
●Grant Wilson, Inc., Chicago, Ill. (Rockwool)
Hinde & Dauch Paper Co., Sandusky, O.
Insulite Div. Minnesota and Ontario Paper Co., Minneapolis, Minn. (Wood fibre)
Insul-Wool Insulation Corp., Wichita, Kan.
International Vermiculite Co., Springfield, Ill. (Loose fill)
●Johns-Manville, New York, N. Y. (Rock wool and wood fibreboard)
Johnston Tin Foil & Metal Co., St. Louis, Mo. (Foil, aluminum, tin, lead)
Keasbey Co., Robert A., New York, N. Y. (Rock wool)
Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
Kimberly-Clark Corp., Neenah, Wis.
Marblehead Lime Co., Chicago, Ill. (Rock wool)
Masonite Corp., Cellufoam Products Div., Chicago, Ill.
Mineral Insulation Co., Chicago Ridge, Ill. (Rock wool)
Mitchell & Smith, Inc., Detroit, Mich. (Cork)
●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
Munn and Steele, Inc., Newark, N. J.
National Gypsum Co., Buffalo, N. Y.
●Owens-Corning Fiberglas Corp., Toledo, O.
Pacific Lumber Co., The, San Francisco, Cal.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plastergon Wall Board Co., Buffalo, N. Y. (Rigid board)
Refractory & Insulation Corp., New York, N. Y. (Rock, slag wool)
Reynolds Metals Co., Richmond, Va.
Robinson Insulation Co., Great Falls, Mont.
Rock Wool Products Co., Wabasn, Ind. (Loose fill)
Ruberoid Co., New York, N. Y. (Mineral wool and aluminum foil)
Russell Co., F. C., Cleveland, O.
Silvercote Products, Inc., Chicago, Ill.
Specialty Converters, Inc., East Braintree, Mass. (Reflective insulation)
Sprayo-Flake Co., Chicago, Ill.
Standard Asbestos Mfg. Co., Chicago, Ill. (Asbestos, hairfelt)
Standard Lime & Stone Co., Baltimore, Md. (Rock wool)
Therminsul Corp., Kalamazoo, Mich. (Rock wool block)
Truscon Steel Co., Youngstown, O. (Insulation board sealed between metal sheets)
United Cork Companies, Lyndhurst, N. J. (Cork)
United States Gypsum Co., Chicago, Ill. (Wool and board)
United States Mineral Wool Co., Chicago, Ill. (Mineral wool)
Universal Gypsum & Lime Co., Chicago, Ill. (Loose fill)
Universal Zonolite Insulation Co., Chicago, Ill. (Loose fill)
Upson Co., Lockport, N. Y.
Wilson & Co., Chicago, Ill. (Board)
●Wilson, Inc., Grant, Chicago, Ill. (Rock wool)
Wood Conversion Co., St. Paul, Minn.

INSULATION, CEILING AND WALL, SOUND DEADENING

Acoustical treatment only—for thermal insulation, see Insulation, Building

Air-O-Cel Industries, Inc., Detroit, Mich.
American Hair & Felt Co., Chicago, Ill.
Armstrong Cork Co., Lancaster, Pa.
●Baldwin-Hill Co., Trenton, N. J.
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Berry, Jr. & Co., F. E., Everett, Mass.
Celotex Corp., The, Chicago, Ill.
Doheny Co., John J., Belmont, Mass.
Felters Co., Inc., Boston, Mass.
Fir-Tex Insulating Board Co., St. Helens, Ore.
General Insulating Products Co., Brooklyn, N. Y.
Insulite Div. Minnesota and Ontario Paper Co., Minneapolis, Minn.
Insul-Wool Insulation Corp., Wichita, Kan.
●Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Lucius, Wm. I., New York, N. Y.
Masonite Corp., Chicago, Ill. (Fibreboard)
Mitchell & Smith, Inc., Detroit, Mich.
●Mundet Cork Corp., Brooklyn, N. Y.
National Gypsum Co., Buffalo, N. Y.
●Owens-Corning Fiberglas Corp., Toledo, O.
Pacific Lumber Co., The, San Francisco, Cal.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Reynolds Metals Co., Richmond, Va.
Robinson Insulation Co., Great Falls, Mont.
Sprayo-Flake Co., Chicago, Ill.
Therminsul Corp., Kalamazoo, Mich.
Universal Zonolite Insulation Co., Chicago, Ill.
Upson Co., Lockport, N. Y.
Western Silicair Products, Inc., Burbank, Cal.
Wood Conversion Co., St. Paul, Minn.

INSULATION, DUCT, SOUND DEADENING

For application inside duct

American Hair & Felt Co., Chicago, Ill.
●Baldwin-Hill Co., Trenton, N. J. (Rock wool)
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Berry, Jr. & Co., Inc., F. E., Everett, Mass.
Cabot, Inc., Samuel, Boston, Mass.
●Carey Mfg. Co., Philip, Cincinnati, O.
Cellufoam Products Div., Masonite Corp., Chicago, Ill.
Celotex Corp., The, Chicago, Ill.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Felters Co., Inc., Boston, Mass.
●Grant Wilson, Inc., Chicago, Ill.
Insulite Div. Minnesota and Ontario Paper Co., Minneapolis, Minn.
●Johns-Manville, New York, N. Y.
Kimberly-Clark Corp., Neenah, Wis.
Maxim Silencer Co., Hartford, Conn.
Mortell Co., J. W., Kankakee, Ill.
Nelson Mfg. Co., B. F. Minneapolis, Minn.
●Owens-Corning Fiberglas Corp., Toledo, O.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
Poe Co., C. W., Cleveland, O.
Reynolds Metals Co., Richmond, Va.
Robinson Insulation Co., Great Falls, Mont.
Seneca Rock Wool Co., Tiffin, O.
Telsit Insulation Co., Bronx, N. Y.
Universal Zonolite Insulation Co., Chicago, Ill.
●Western Felt Works, Chicago, Ill.
Western Silicair Products, Inc., Burbank, Cal.
●Wilson, Inc., Grant. Chicago, Ill.

INSULATION, DUCT, THERMAL

Acme Asbestos Covering & Flooring Co., Chicago, Ill. (Asbestos)
Air-O-Cel Industries, Inc., Detroit, Mich.
Alfol Insulation Co., New York, N. Y. (Aluminum foil)
American Flange & Mfg. Co., Inc., New York, N. Y. (Metal sheets)
American Hair & Felt Co., Chicago, Ill. (Hair felt)
Armstrong Cork Co., Lancaster, Pa. (Corkboard, fibreboard)
●Baldwin-Hill Co., Trenton, N. J.
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Berry, Jr. & Co., Inc., F. E., Boston, Mass.
Cabot, Inc., Samuel, Boston, Mass. (Flexible)
●Carey Mfg. Co., Philip, Lockland, Cincinnati, O. (Asbestos)
Cellufoam Products Div., Masonite Corp., Chicago, Ill.
Celotex Corp., The, Chicago, Ill.
Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., Inc., New York, N. Y. (Cork board)
Dry-Zero Corp., Chicago, Ill.
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool blankets)
Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Cork, magnesia, hair felt)
Felters Co., Inc., Boston, Mass. (Wool felt)
Fir-Tex Insulating Board Co., St. Helens, Ore. (Wood fibreboard)
General Insulating Products Co., Brooklyn, N. Y. (Acoustic rock wool)
●Grant Wilson, Inc., Chicago, Ill.
Insulite Div. Minnesota and Ontario Paper Co., Minneapolis, Minn. (Wood fibre)
International Vermiculite Co., Springfield, Ill. (Block)
●Johns-Manville, New York, N. Y. (Rock cork, asbestos)
Keasbey Co., Robert A., New York, N. Y. (Asbestos and cork)
Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
Kennedy, Inc., David E., Brooklyn, N. Y.
Keystone Asphalt Products Co., Chicago, Ill.

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Kimberly-Clark Corp., Neenah, Wis.
Miller Rubber Co., Inc., Akron, O.
Mineral Insulation Co., Chicago Ridge, Ill. (Rock wool)
Mitchell & Smith, Inc., Detroit, Mich. (Cork)
●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
Munn and Steele, Inc., Newark, N. J.
National Gypsum Co., Buffalo, N. Y. (Block)
Nelson Mfg. Co., B. F., Minneapolis, Minn.
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Asbestos and wool felt)
●Owens-Corning Fiberglas Corp., Toledo, O. (Blanket)
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
Quigley Co., Inc., New York, N. Y.
Refractory & Insulation Corp., New York, N. Y. (Block, blanket)
Reynolds Metals Co., Richmond, Va.
Robinson Insulation Co., Great Falls, Mont.
Rock Wool Products Co., Wabash, Ind.
Ruberoid Co., New York, N. Y. (Asbestos cellular and laminated sheets or blocks)
Sall Mountain Co., Chicago, Ill. (Asbestos)
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Smith & Kanzler Corp., Elizabeth, N. J. (Asbestos air cell type)
Sprayo-Flake Co., Chicago, Ill.
Standard Asbestos Mfg. Co., Chicago, Ill. (Asbestos, hair felt)
Telsit Insulation Co., Bronx, N. Y.
Therminsul Corp., Kalamazoo, Mich. (Rock wool bats, loose and granulated)
United Cork Companies, Lyndhurst, N. J. (Cork)
United States Mineral Wool Co., Chicago, Ill.
Universal Zonolite Insulation Co., Chicago, Ill. (Plastic)
●Western Felt Wks., Chicago, Ill. (Felt)
Wilson & Co., Chicago, Ill. (Flexible)
●Wilson, Inc., Grant, Chicago, Ill.
Wood Conversion Co., St. Paul, Minn.

INSULATION, PIPE

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Alfol Insulation Co., New York, N. Y. (Aluminum foil)
●American District Steam Co., North Tonawanda, N. Y. (Underground)
American Hair & Felt Co., Chicago, Ill.
Armstrong Cork Co., Lancaster, Pa. (Cork)
●Baldwin-Hill Co., Trenton, N. J. (Rock wool)
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
●Carey Mfg. Co., Philip, Lockland, Cincinnati, O. (Asbestos, magnesia)
Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., New York, N. Y.
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool)
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
●Grant Wilson, Inc., Chicago, Ill.
International Vermiculite Co., Springfield, Ill. (Vermiculite)
Jamar Co., Walker, Duluth, Minn.
●Johns-Manville, New York, N. Y. (Asbestos, magnesia, rock cork)
Keasbey Co., Robert A., New York, N. Y. (Asbestos and cork)
Keasbey & Mattison Co., Ambler, Pa. (Asbestos, magnesia)
Miller Rubber Co., Inc., Akron, O. (Sponge rubber)
Mitchell & Smith, Inc., Detroit, Mich. (Cork)
●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
National Gypsum Co., Buffalo, N. Y. (Moulded)
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Asbestos, magnesia)
●Owens-Corning Fiberglas Corp., Toledo, O. (Sectional and flexible)
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
●Porter & Co., Inc., H. W., Newark, N. J. (Underground)
●Ric-wiL Co., Cleveland, O. (Underground)
Robinson Insulation Co., Great Falls, Mont.
Ruberoid Co., New York, N. Y. (Asbestos, magnesia)
Sall Mountain Co., Chicago, Ill. (Asbestos)
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Smith & Kanzler Corp., Elizabeth, N. J. (Asbestos air cell, wool felt and hair felt)
Standard Asbestos Mfg. Co., Chicago, Ill.
Standard Lime & Stone Co., Baltimore, Md. (Rockwool)
Union Asbestos & Rubber Co., Cicero, Ill.
United Cork Companies, Lyndhurst, N. J.
Universal Zonolite Insulation Co., Chicago, Ill.
Walker Jamar Co., Duluth, Minn.
●Wilson, Inc., Grant, Chicago, Ill.
Wyckoff & Son Co., A., Elmira, N. Y. (Wood)

IONIZATION APPARATUS

Coroaire Heater Corp., The, Cleveland, O.
Electroaire Corp., Chicago, Ill.
Montgomery Bros., San Francisco, Cal.
Norwood Filtration Co., The, Florence, Mass.
Ozo-Ray Process Corp., Chicago, Ill.
United States Ozone Co. of America, Scottdale, Pa.

IRON BODY VALVES

See Valves, Gate; and Valves, Globe

JACKETED PIPE

See Pipe, Jacketed

JOINTS, FLEXIBLE SWING

Barco Mfg. Co., Chicago, Ill.
Bordo Co., Inc., L. J., Glenside, Pa.
Patterson-Ballagh Corp., Los Angeles, Cal.

JOINTS, PIPE, ELECTRICAL INSULATING

Barco Mfg. Co., Chicago, Ill.
Dresser Mfg. Co., Bradford, Pa.

JOINTS, PIPE, EXPANSION, PACKLESS

●American District Steam Co., North Tonawanda, N. Y.
Badger Fire Extinguisher Co., Boston, Mass.
Badger & Sons Co., E. B., Boston, Mass. (Corrugated copper, stainless steel)
Barco Mfg. Co., Chicago, Ill.
Belfield Co., H., Philadelphia, Pa.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Foster Wheeler Corp., New York, N. Y.
●Fulton Sylphon Co., Knoxville, Tenn.
Griscom-Russell Co., The, New York, N. Y.
Harris & Co., Arthur, Chicago, Ill.
Kopperman & Sons, Joseph, Philadelphia, Pa.
Northern Indiana Brass Co., Elkhart, Ind.
Semet-Solvay Engineering Corp., New York, N. Y.
●Taylor Forge & Pipe Wks., Chicago, Ill.
United States Rubber Co., New York, N. Y.
Walworth Co., New York, N. Y.
Zallea Brothers & Johnson, Wilmington, Del.

JOINTS, PIPE, EXPANSION, SLIP

●American District Steam Co., North Tonawanda, N. Y.
Dresser Mfg. Co., Bradford, Pa.
Duriron Co., Inc., Dayton, O. (Acid resisting)
●Fulton Sylphon Co., Knoxville, Tenn.
Hasco Valve & Machine Co., Milwaukee, Wis.
Howard Iron Works & Alberger Heater Co., Buffalo, N. Y.
●Illinois Engineering Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Northern Indiana Brass Co., Elkhart, Ind.
Schade Valve Mfg. Co., Philadelphia, Pa.
Semet-Solvay Engineering Corp., New York, N. Y.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
●Taylor Forge & Pipe Wks., Chicago, Ill.
Walworth Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
●Yarnall-Waring Co., Philadelphia, Pa.

JOINTS, UNIVERSAL, FOR OPERATING VALVES

Brooks Equipment Corp., New York, N. Y.
Consolidated Car-Heating Co., Inc., Albany, N. Y.

KATA THERMOMETERS

See Thermometers, Kata

LACQUERS

See Enamels and Lacquers

LAMPS, STERILIZING, FOR DUCT INSTALLATION

General Electric Co., Lamp Dept., Nela Park, Cleveland, O.
Westinghouse Electric & Mfg. Co., Bloomfield, N. J.

LEAD PIPE

See Pipe, Lead

LEAD SHEETS

See Sheets, Lead

LEAK DETECTORS

See Detectors, Leak, Refrigerant

LEATHER BELTING

See Belting, Flat, Leather

LEATHER PACKING

See Packing, Leather

LIGHTS, PILOT AND SIGNAL

Armstrong Heat Control Co., Portland, Ore.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Dial Light Co. of America, Inc., New York, N. Y.
●General Controls Co., Glendale, Cal.
General Electric Co., Lamp Dept., Nela Park, Cleveland, O.
Signal Indicator Co., New York, N. Y.

LIQUID LEVEL GAGES

See Gages, Liquid Level

LIQUID LEVEL RECORDERS

See Recorders, Liquid Level

LIQUID PRESSURE REGULATORS

See Regulators, Pressure, Liquid

LOCK FORMING MACHINES

See Machines, Pittsburgh Lock Forming

LOCK NUTS

See Nuts, Lock

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LOUVERS AND SHUTTERS, AUTOMATICALLY OR MANUALLY CONTROLLED

Air Conditioning Products Co., Detroit, Mich.
Air Control Products, Inc., Muskegon, Mich.
Air Controls, Inc., Cleveland, O.
Airmaster Corp., Chicago, Ill.
Allen Corp., Detroit, Mich.
American Blower Corp., Detroit, Mich.
American Coolair Corp., Jacksonville, Fla.
American Foundry & Furnace Co., Bloomington, Ill.
American Warming & Ventilating Co., Toledo, O.
Ames Co., W. R., San Francisco, Cal.
Arex Co., Chicago, Ill.
Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.
●Barber-Colman Co., Rockford, Ill.
Belanger Fan & Blower Co., Detroit, Mich.
Belco Exhaust Fan Mfg. Co., St. Louis, Mo.
●Bishop & Babcock Mfg. Co., Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Burt Mfg. Co., Akron, O.
California Cornice, Steel & Supply Corp., Los Angeles, Cal.
Campbell Heating Co., E. K., Kansas City, Mo.
Champion Blower & Forge Co., Lancaster, Pa.
Chelsea Fan & Blower Co., Irvington, N. J.
Chicago Metal Mfg. Co., Chicago, Ill.
Circulators & Devices Mfg. Corp., New York, N. Y.
Clay Equipment Corp., Cedar Falls, Ia.
Dual Air Fan Co., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Elgo Shutter & Mfg. Co., Detroit, Mich.
Gillian Mfg. Co., Detroit, Mich.
Guth Co., Edwin F., St. Louis, Mo.
Hirschman Co., W. F., Buffalo, N. Y.
International Engineering, Inc., Dayton, O.
International Steel Co., Evansville, Ind.
Jamieson Mfg. Co., Dallas, Tex.
Johnson Fan & Blower Corp., Chicago, Ill.
Johnston Co., William W., Dayton, O.
Jordan & Co., Paul R., Indianapolis, Ind.
Kelvin-White Co., Boston, Mass.
King Ventilating Co., Owatonna, Minn.
Kirk & Blum Mfg. Co., Cincinnati, O.
Leslie Welding Co., Chicago, Ill.
Lockjoint Wood Products Co., Wichita, Kans. (Wood; stationary door, wall, window and ceiling)
Lohman Co., Wm. J., Irvington, N. J.
Martin Metal Mfg. Co., Wichita, Kan.
Meier Electric & Machine Co., Indianapolis, Ind.
Meyer Mfg. Co., Detroit, Mich.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Mountain States Equipment Co., Denver Colo.
Myers Electric Co., Inc., Pittsburgh, Pa.
Peerless Electric Co., Warren, O.
Reed Unit-Fans, Inc., New Orleans, La.
Robertson Co., H. H., Pittsburgh, Pa.
Schoedinger, F. O., Columbus, O.
Signal Electric Mfg. Co., Menominee, Mich.
Standard Stamping & Perforating Co., Chicago, Ill.
Supreme Heater & Ventilating Corp., St. Louis, Mo. (Oscillating)
●Tuttle & Bailey, Inc., New Britain, Conn.
United States Register Co., Battle Creek, Mich.
Utility Fan Corp., Los Angeles, Cal.
Van Noorden Co., E., Boston, Mass.
Waterloo Register Co., Waterloo, Ia.

LOW WATER CUT-OFFS

See Cut-Offs, Low Water, Heating Boiler

MACHINES, BLUE PRINT AND WHITE PRINT

For Reproducing Engineering Drawings

Bruning Co., Inc., Charles, Long Island City, N. Y.
Ozalid Products Div., General Aniline & Film Corp., Johnson City, N. Y.
Paragon-Revolute Corp., Rochester, N. Y.
Pease Co., C. F., The, Chicago, Ill.
Peck & Harvey, Chicago, Ill.
Wickes Brothers, Saginaw, Mich.

MACHINES AND FILM, X-RAY

Eastman Kodak Co., Rochester, N. Y.
Kelly-Koet, Covington, Ky.
Westinghouse X-Ray Co., Inc., Long Island City, N. Y.

MACHINES, PIPE CUTTING AND THREADING, PORTABLE

●Air Reduction Sales Co., New York, N. Y. (Cutting and beveling)
Beaver Pipe Tools, Inc., Warren, O.
Curtis & Curtis Co., Bridgeport, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
Linde Air Products Co., The, New York, N. Y. (Cutting and beveling)
●National Machine Works, Chicago, Ill.
Nye Tool & Machine Wks., The, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Peerless Mach. Co., Racine, Wis.
Ridge Tool Co., Elyria, O. (Hand)
Toledo Pipe Threading Machine Co., Toledo, O.

MACHINES, PIPE CUTTING AND THREADING, STATIONARY

Beaver Pipe Tools, Inc., Warren, O.
Bignall & Keeler Machine Wks., Edwardsville, Ill.
Curtis & Curtis Co., Bridgeport, Conn.
Jarecki Mfg. Co., Erie, Pa.
Landis Machine Co., Inc., Waynesboro, Pa.
Merrell Mfg. Co., Toledo, O.
Oster Mfg. Co., Cleveland, O.
Saunders Sons, Inc., D., Yonkers, N. Y.
Spence Engineering Co., Inc., Walden, N. Y. (Beveling and cutting machine)
Toledo Pipe Threading Machine Co., Toledo, O.

MACHINES, PITTSBURGH LOCK FORMING

Binkley Mfg. Co., Warrenton, Mo.
Lockformer Co., Chicago, Ill.
Maplewood Machinery Co., Inc., Chicago, Ill.
Rafter Machine Co., Belleville, N. J.
Whitney Metal Tool Co., Rockford, Ill.

MACHINES, REFRIGERATION, ABSORPTION

●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Vogt Machine Co., Henry, Louisville, Ky.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
●York Ice Machinery Corp., York, Pa.

MACHINES, VERTICAL, THREADING AND BORING

●Bullard Co., The, Bridgeport, Conn.

MALLEABLE UNIONS

See Unions, Malleable

MANIFOLDS, REFRIGERATION

●Baker Ice Machine Co., Inc., Omaha, Neb.
●Frick Co., Waynesboro, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Kerotest Mfg. Co., Pittsburgh, Pa.
Superior Valve and Fittings Co., Pittsburgh, Pa.
●York Ice Machinery Corp., York, Pa.

MANOMETERS

Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

MECHANICAL DRIVE TURBINES

See Turbines, Mechanical Drive

MECHANICAL SPEED CHANGERS

See Changers, Speed, Mechanical

MECHANICAL TRAPS

See Traps, Steam, Mechanical

MERCURY SWITCHES

See Switches, Mercury

METAL HOSE

See Hose, Metal, for Eliminating Compressor Vibration

METALLIC PACKING

See Packing, Metallic

METERS, AIR VELOCITY, DIRECT READING

Detroit Air Meter Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
●Taylor Instrument Companies, Rochester, N. Y.

METERS, CONDENSATION

●American District Steam Co., North Tonawanda, N. Y.
Buffalo Meter Co., Buffalo, N. Y.
Central Station Steam Co., Detroit, Mich.
●Cochrane Corp., Philadelphia, Pa.
Morehead Mfg. Co., Detroit. Mich.
Neptune Meter Co., New York, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Worthington-Gamon Meter Co., Harrison, N. J.

METERS, FLOW, REFRIGERANT

Bristol Co., Waterbury, Conn.
Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
Neptune Meter Co., New York, N. Y.

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METERS, FLOW, STEAM

●American District Steam Co., North Tonawanda, N. Y.
American Meter Co., New York, N. Y.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
●Cochrane Corp, Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

METERS, PROCESS LIQUID

American Meter Co., Inc., New York, N. Y.
Bailey Meter Co., Cleveland, O.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Buffalo Meter Co., Buffalo, N. Y.
Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
●Cochrane Corp., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Neptune Meter Co., New York, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.
Schutte & Koerting Co., Philadelphia, Pa.
●Taylor Instrument Companies, Rochester, N. Y.
Worthington-Gamon Meter Co., Harrison, N. J.

METERS, WATER

Bailey Meter Co., Cleveland, O.
Buffalo Meter Co., Buffalo, N. Y.
Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Morey & Jones, Ltd., Los Angeles, Cal.
National Meter Co., Brooklyn, N. Y.
Neptune Meter Co., New York, N. Y.
Pfening Co., Fred D., Columbus, O.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Republic Flow Meters Co., Chicago, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.
Union Water Meter Co., Worcester, Mass.
Worthington-Gamon Meter Co.. Harrison, N. J.

MIXING VALVES

See Valves, Mixing, Steam and Water

MODULATING VALVES

See Valves, Radiator, Steam and Hot Water

MOTOR BASES

See Bases and Pads, Vibration Isolating; Bases, Motor, Tension Adjusting

MOTOR CONTROLLERS

See Controllers and Starters, Motor

MOTOR OPERATED VALVES

See Valves, Motor Operated

MOTOR STARTERS

See Controllers and Starters, Motor

MOTORS, ELECTRIC, FRACTIONAL HP

Baldor Electric Co., St. Louis, Mo.
●Barber-Colman Co., Rockford, Ill.
Bodine Electric Co., Chicago, Ill.
Brown-Brockmeyer Co., Dayton, O.
Canatsey Electric Mfg. Co., Kansas City, Mo.
●Century Electric Co., St. Louis, Mo.
Delco Appliance Co., Rochester, N. Y.
Delco Products Corp., Dayton, O.
Diehl Mfg. Co., Elizabethport, N. J.
Emerson Electric Mfg. Co., The, St. Louis, Mo.
●General Electric Co., Schenectady, N. Y.
Holtzer-Cabot Electric Co., Boston, Mass.
●Howell Electric Motors Co., Howell, Mich.
Janette Mfg. Co., Chicago, Ill.
Leland Electric Co., Dayton, O.
Marathon Electric Mfg. Corp., Wausau, Wis.
Master Electric Co., Dayton, O.
Ohio Electric Mfg. Co., Cleveland, O.
Peerless Electric Co., Warren, O.
Reynolds Electric Co., Chicago, Ill.
Robbins & Myers, Inc., Springfield, O.
Russell Electric Co., Chicago, Ill.
Small Motors, Inc., Chicago, Ill.
Speedway Mfg. Co., Chicago (Cicero), Ill.
Sterling Electric Motors, Inc., Los Angeles, Cal.
●Sturtevant Co., B. F., Boston, Mass.
U. S. Electrical Motors, Inc., Los Angeles, Cal.
Victor Electric Products, Inc., Cincinnati, O.
Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS, ELECTRIC, 1 HP AND OVER

Allis Co., Louis, The, Milwaukee, Wis.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Baldor Electric Co., St. Louis, Mo.
Bogue Electric Co., Paterson, N. J.
Brown-Brockmeyer Co., Dayton, O.
Burke Electric Co., Erie, Pa.
Canatsey Electric Mfg. Co., Kansas City, Mo.
●Century Electric Co., St. Louis, Mo.
Continental Electric Co., Inc., Newark, N. J.
Crocker-Wheeler Elec. Mfg. Co., Ampere, N. J.
Delco Products Corp., Dayton, O.
Diehl Mfg. Co., Elizabethport, N. J.
Electric Machinery Mfg. Co., Minneapolis, Minn.
Emerson Electric Mfg. Co., The, St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.
●General Electric Co., Schenectady, N. Y.
●Howell Electric Motors Co., Howell, Mich.
Ideal Electric & Mfg. Co., Mansfield, O.
Imperial Electric Co., Akron, O.
Janette Mfg. Co., Chicago, Ill.
Leland Electric Co., Dayton, O.
Lincoln Electric Co., Cleveland, O.
Marathon Electric Mfg. Corp., Wausau, Wis.
Marble-Card Electric Co., Gladstone, Mich.
Master Electric Co., Dayton, O.
Peerless Electric Co., Warren, O.
Philadelphia Gear Works, Inc., Philadelphia, Pa. (Geared)
Reliance Electric & Engineering Co., Cleveland, O.
Robbins & Myers, Inc., Springfield, O.
Star Electric Motor Co., Bloomfield, N. J.
Sterling Electric Motors, Inc., Los Angeles, Cal.
●Sturtevant Co., B. F., Boston, Mass.
U. S. Electrical Motors, Inc., Los Angeles, Cal.
Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Zobell Electric Motor Corp., Garwood, N .J.

MUSHROOM VENTILATORS

See Ventilators, Mushroom

NEEDLE VALVES

See Valves, Needle

NEUTRALIZERS, ACID

See Dehydrant and Acid Neutralizer

NICKEL AND NICKEL ALLOY PIPE AND FITTINGS

See Tubing, Nickel and Nickel Alloy; Fittings, Pipe, Nickel and Nickel Alloy; Pipe, Nickel and Nickel Alloy

NICKEL AND NICKEL ALLOY SHEETS

See Sheets, Nickel and Nickel Alloy

NIPPLES, PIPE, BRASS AND COPPER

Acheson Mfg. Co., Rankin, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Nipple Mfg. Co., Chicago, Ill.
Crane Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
●Ellsworth Pipe & Supply Co., Milwaukee, Wis.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Mueller Brass Co., Port Huron, Mich.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Phoenix Brass Fittings Corp., Irvington, N. J.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
Weatherhead Co., Cleveland, O

NIPPLES, PIPE, IRON AND STEEL

Alabama Pipe Co., Anniston, Ala. (Cast iron)
Alloy Steel Products Co., Linden, N. J. (Stainless steel)
●Byers Co., A. M., Pittsburgh, Pa. (Wrought iron)
Chicago Nipple Mfg. Co., Chicago, Ill.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Dresser Mfg. Co., Bradford, Pa.
●Ellsworth Pipe & Supply Co., Milwaukee, Wis.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Hasco Valve & Machine Co., Milwaukee, Wis.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie. Pa.
Parmelee Mfg. Corp., Utica, N. Y. (Radiator push)
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.

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NOISE ELIMINATORS

See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration; Insulation, Sound Deadening

NOZZLES, SPRAY

Balloffet Dies and Nozzle Co., Inc., Guttenberg, N. J.
Bayley Blower Co., Milwaukee, Wis.
Benjamin Air Rifle Co., St. Louis, Mo.
Betz Air Conditioning Corp., Kansas City, Mo.
●Binks Mfg. Co., Chicago, Ill.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Chain Belt Co., Milwaukee, Wis.
●Clarage Fan Co., Kalamazoo, Mich.
DeVilbiss Co., The, Toledo, O.
Dustlix Corp., Milwaukee, Wis.
Fluor Corp., Ltd., The, Los Angeles, Cal.
International Moistening Co., Providence, R. I.
Link-Belt Co., Chicago, Ill.
Lonn Mfg. Co., Inc., Chicago, Ill.
●Marley Co., Kansas City, Kans.
Martocello & Co., Jos. A., Philadelphia, Pa.
Milburn Co., Alexander, Baltimore, Md.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
Northern Indiana Brass Co., Elkhart, Ind.
Parks-Cramer Co., Fitchburg, Mass.
Peterson Freezem Mfg. & Sales Co., Kansas City, Mo.
Phillips Cooling Tower Co., Inc., New York, N. Y.
Plummer Spray Equipment Co., Napoleon, O.
Pritchard & Co., J. F., Kansas City, Mo.
Rega Mfg. Co., Rochester, N. Y.
Ross Sprinkler Co., Pasadena, Cal.
Schubert-Christy Corp., Affton Station, St. Louis, Mo.
Schutte & Koerting Co., Philadelphia, Pa.
Skinner Irrigation Co., Troy, O.
Spray Engineering Co., Somerville, Mass.
●Spraying Systems Co., Chicago, Ill.
Strandwitz & Co., Inc., W. J., Camden, N. J.
●Sturtevant Co., B. F., Boston, Mass.
Supreme Electric Products Corp., Rochester, N. Y.
●Trane Co., La Crosse, Wis.
Water Cooling Corp., New York, N. Y.
●Yarnall-Waring Co., Philadelphia, Pa.

NUTS, LOCK

Elastic Stop Nut Corp., Union, N. J.
●Grinnell Co., Inc., Providence, R. I.
Industrial Lock Nut Co., South Hanover, Mass.
Kwikon Co., Chicago, Ill.
Locknut Corp. of America, Chicago, Ill.
MacLean-Fogg Lock Nut Co., Chicago, Ill.
●Malleable Iron Fittings Co., Branford, Conn.
Palnut Co., Irvington, N. J.
Rockford Brass Works, Rockford, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Walworth Co., New York, N. Y.

OBSERVATION BOILER PORTS

See Ports, Observation, Boiler

ODOR ADSORBERS

See Filters, Air; Adsorbers, Odor

ODOR NEUTRALIZERS

See Adsorbers, Odor

OIL BURNERS

See Burners, Oil

OIL COOLERS

See Coolers, Oil

OIL SEPARATORS

See Separators, Steam and Oil

OPEN END WRENCHES

See Wrenches, Open End

OPERATORS, DAMPER, DUCT

Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
Cook Electric Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●Fulton Sylphon Co., Knoxville, Tenn.
●General Controls Co., Glendale, Cal.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Young Regulator Co., Cleveland, O.

OPERATORS, VALVE

Au-Temp-Co Corp., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bristol Co., Waterbury, Conn.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Cook Electric Co., Chicago, Ill.
Cooper Co., Clark, Philadelphia, Pa.
Crane Co., Chicago, Ill.
Cutler-Hammer, Inc., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
●Fulton Sylphon Co., Knoxville, Tenn.
●General Controls Co., Glendale, Cal.
●Johnson Service Co., Milwaukee, Wis.
Mason-Neilan Regulator Co., Boston, Mass.
●McDonnell & Miller, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies. Rochester, N. Y.

ORIFICES, RADIATOR

Armstrong Heat Control Co., Portland, Ore.
Au-Temp-Co Corp., New York, N. Y.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
●Dunham Co., C. A., Chicago, Ill.
●Haines & Co., William S., Philadelphia, Pa.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
New York Air Valve Corp., New York, N. Y.
●Sarco Co., Inc., New York, N. Y.
Spence Engineering Co., Inc., Walden, N. Y.
Sterling, Inc., Milwaukee, Wis.
Tallmadge & Co., Webster, East Orange, N. J.
Thrush & Co., H. A., Peru, Ind.
●Trane Co., La Crosse, Wis.
●Webster & Co., Warren, Camden, N. J.
Webster Tallmadge & Co., East Orange, N. J.

OXY-ACETYLENE WELDING

See Welding and Cutting Apparatus, Oxy-Acetylene

OZONE APPARATUS

Automatic Pump & Softener Corp., Rockford, Ill.
Chelsea Fan & Blower Co, Irvington, N. J.
Coroaire Heater Corp., The, Cleveland, O.
Electroaire Corp., Chicago, Ill.
Lohman Co., Wm. J., Irvington, N. J.
Montgomery Bros., San Francisco, Cal.
Norwood Filtration Co., The, Florence, Mass.
Ozone Air Co., Grand Rapids, Mich.
Ozo-Ray Process Corp., Chicago, Ill.
Russell Electric Co., Chicago, Ill.
Sealkote Corp., Chicago, Ill.
United States Ozone Co. of America, Scottdale, Pa.

PACKING, ASBESTOS

Acme Asbestos Coverings & Flooring Co., Chicago, Ill.
Aeco Packing Products Co., Chicago, Ill.
Allpax Co., Inc., Mamaroneck, N. Y.
Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., The, Philadelphia, Pa.
●Carey Mfg. Co., Philip, Lockland, Cincinnati, O.
Chicago Specialty Mfg. Co., Chicago, Ill.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y.
Durabla Mfg. Co., New York, N. Y.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Felt Products Mfg. Co., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Goodyear Tire & Rubber Co., Akron, O.
Greene, Tweed & Co., New York, N. Y.
●Jenkins Bros., New York, N. Y.
●Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Klingerit, Inc., New York, N. Y. (Sheet & rod)
Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
Metallo Gasket Co., New Brunswick, N. J.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Quaker Rubber Corp., Philadelphia, Pa.
Sall Mountain Co., Chicago, Ill.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
Union Asbestos & Rubber Co., Cicero, Ill.
United States Rubber Co., New York, N. Y.

PACKING, FIBER

Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., The, Philadelphia, Pa.
Darcoid Co., Inc., New York, N. Y.
Durabla Mfg. Co., New York, N. Y.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Endura Mfg. Corp., Quakertown, Pa.
Garlock Packing Co., Palmyra, N. Y.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
●Jenkins Bros., New York, N. Y.
●Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y.

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Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
McQuay-Norris Mfg. Co., St. Louis, Mo.
Metallo Gasket Co., New Brunswick, N. J.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Paxtix, Inc., Chicago, Ill.
Quaker Rubber Corp., Philadelphia, Pa.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
Union Asbestos & Rubber Co., Cicero, Ill.
United States Rubber Co., New York, N. Y.

PACKING, LEATHER

Alexander Bros., Philadelphia, Pa.
Belmont Packing & Rubber Co., The, Philadelphia, Pa.
Chicago Belting Co., Chicago, Ill.
Crane Packing Co., Chicago, Ill.
Excelsior Leather Washer Mfg. Co., Rockford, Ill.
Graton & Knight Co., Worcester, Mass.
Houghton & Co., E. F., Philadelphia, Pa.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
●**Rhoads & Sons, J. E., Philadelphia, Pa.**
Schieren Co., Chas. A., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.
Williams & Son, I. B., Dover, N. H.

PACKING, METALLIC

Aeco Packing Products Co., Chicago, Ill.
Allpax Co., Inc., Mamaroneck, N. Y.
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., The, Philadelphia, Pa.
Conneaut Packing Co., Conneaut, O.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y.
Felt Products Mfg. Co., Chicago, Ill.
France Packing Co., Tacony, Philadelphia, Pa.
Garlock Packing Co., Palmyra, N. Y.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Hound Packing Co., Chicago, Ill.
●Johns-Manville, New York, N. Y.
Klingerit, Inc., New York, N. Y. (Sheet & rod)
Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
●McQuay-Norris Mfg. Co., St. Louis, Mo.
National Engineering Products, Inc., Washington, D. C.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Rotary Seal Co., Chicago, Ill.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
Union Asbestos & Rubber Co., Cicero, Ill.
United States Rubber Co., New York, N. Y.

PACKING, RUBBER

Aeco Packing Products Co., Chicago, Ill.
Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., The, Philadelphia, Pa.
Boston Woven Hose & Rubber Co., Cambridge, Mass.
Chicago Belting Co., Chicago, Ill. (Synthetic)
Chicago Specialty Mfg. Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Garlock Packing Co., Palmyra, N. Y.
Gates Rubber Co., Denver, Colo.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Hamilton Rubber Mfg. Co., Trenton, N. J.
●Jenkins Bros., New York, N. Y.
●Johns-Manville, New York, N. Y.
Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan Inc., Passaic, N. J.
Miller Rubber Co., Inc., Akron, O.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Quaker Rubber Corp., Philadelphia, Pa.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
Resistoflex Corp., Belleville, N. J. (Synthetic resin)
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
Union Asbestos & Rubber Co., Cicero, Ill.
United States Rubber Co., New York, N. Y.

PARTS FOR HEATING AND AIR CONDITIONING EQUIPMENT

Ackermann Mfg. Co., Wheeling, W. Va.
●**Carey Mfg. Co., Philip, Cincinnati, O. (Insulating panel for housing and duct construction)**
●**Commercial Shearing & Stamping Co., Youngstown, O. (Tank heads and bottoms, water heater legs, furnace stampings, etc.)**
Dry-Zero Corp., Chicago, Ill. (Cabinet construction for air conditioning and warm air heating equipment)
Geuder, Paeschke & Frey Co., Milwaukee, Wis.
Technical Ply-Woods, Chicago, Ill. (Plywood panel boards)

PILLOW BLOCK BEARINGS

See Bearings, Pillow Block

PILOT LIGHTS

See Lights, Pilot and Signal

PIPE, ALUMINUM

See Tubing, Aluminum

PIPE, ASBESTOS FIBER AND CEMENT

●Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Union Asbestos & Rubber Co., Cicero, Ill.

PIPE BENDERS

See Benders, Pipe

PIPE, BRASS AND COPPER

●American Brass Co., Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Foster Wheeler Corp., New York, N. Y.
●**Hussey & Co., C. G., Pittsburgh, Pa.**
●Mueller Brass Co., Port Huron, Mich.
Revere Copper and Brass, Incorporated, New York, N. Y.
Scovill Mfg. Co., Waterville Div., Waterville, Conn.
Wolverine Tube Co., Detroit, Mich.

PIPE, CAST IRON, PRESSURE, BELL AND SPIGOT

Alabama Pipe Co., Anniston, Ala.
American Cast Iron Pipe Co., Birmingham, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
Duriron Co., Inc., Dayton, O. (Acid resisting)
Inner-Tite Clamp Corp., Elizabeth, N. J.
Lynchburg Foundry Co., Lynchburg, Va.
McWane Cast Iron Pipe Co., Birmingham, Ala.
●National Machine Wks., Chicago, Ill.
U. S. Pipe & Fdry. Co., Burlington, N. J.
Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE, CAST IRON, PRESSURE, FLANGED

Alabama Pipe Co., Anniston, Ala.
American Cast Iron Pipe Co., Birmingham, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
Duriron Co., Inc., Dayton, O. (Acid resisting)
Inner-Tite Clamp Corp., Elizabeth, N. J.
Lynchburg Foundry Co., Lynchburg, Va.
McWane Cast Iron Pipe Co., Birmingham, Ala.
●National Machine Wks., Chicago, Ill.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
U. S. Pipe & Fdry. Co., Burlington, N. J.
Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE, CAST IRON, THREADED

American Cast Iron Pipe Co., Birmingham, Ala.
McWane Cast Iron Pipe Co., Birmingham, Ala.
Somerville Iron Wks., Somerville, N. J.
U. S. Pipe & Foundry Co., Burlington, N. J.
Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE CLEANING COMPOUNDS

See Compounds, Cleaning, Pipe Coil and Condenser

PIPE COILS

See Coils, Pipe

PIPE COUPLINGS

See Couplings, Pipe

PIPE CUTTERS

See Cutters

PIPE CUTTING MACHINES

See Machines, Pipe Cutting and Threading

PIPE EXTRACTORS

See Extractors, Pipe

PIPE FITTINGS

See Fittings, Pipe

PIPE FLANGES

See Flanges, Pipe

PIPE, GLASS

Corning Glass Wks., Corning, N. Y.

PIPE HANGERS

See Hangers and Supports, Pipe

PIPE, HARD RUBBER

American Hard Rubber Co., New York, N. Y.
Goodrich Co., B. F., Akron, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Stokes Rubber Co., Jos., Trenton, N. J.
United States Rubber Co., New York, N. Y.

PIPE INSULATION

See Insulation, Pipe

PIPE, JACKETED

Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Parks-Cramer Co., Fitchburg, Mass.

PIPE JOINT COMPOUNDS

See Cement and Compounds, Pipe Joint

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PIPE, LEAD
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.
Standard Rolling Mills, Inc. Brooklyn, N. Y.

PIPE, LINED
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
●American Brass Co., Waterbury, Conn. (Tin)
American Cast Iron Pipe Co., Birmingham, Ala. (Cement)
American Hard Rubber Co., New York, N. Y. (Rubber)
Cohoes Rolling Mill Co., Cohoes, N. Y. (Cement)
General Plate Div., Metals & Controls Corp., Attleboro, Mass. (Silver lined)
Goodrich Co., B. F., Akron, O. (Rubber-lined)
Jones & Laughlin Steel Corp., Pittsburgh, Pa. (Cement)
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead and tin lined)
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Manhattan Rubber Mfg. Co. Div. of Raybestos-Manhattan, Inc., Passaic, N. J. (Rubber)
National Lead Co., New York, N. Y. (Lead)
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa. (Cement)
Public Works Supply Co., Lynn, Mass. (Cement)
Resisto Pipe & Valve Co., East Cambridge, Mass. (Lead)
United States Rubber Co., New York, N. Y. (Rubber)
Vesco Corp., New York, N. Y. (Enamel)
Warren Foundry & Pipe Corp., New York, N. Y. (Cement-bituminous enamel)
●Youngstown Sheet & Tube Co., Youngstown, O.

PIPE LINE STRAINERS
See Strainers, Pipe Line

PIPE, NICKEL AND NICKEL ALLOY
International Nickel Co., New York, N. Y.

PIPE NIPPLES
See Nipples, Pipe

PIPE, PRE-INSULATED
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
●Ric-wiL Co., Cleveland, O.

PIPE REAMERS
See Reamers, Pipe

PIPE REPAIR CLAMPS
See Clamps, Pipe Repair

PIPE, SPIRAL, RIVETED AND WELDED
American Rolling Mill Co., The, Middletown, O.
Naylor Pipe Co., Chicago, Ill.
●Taylor Forge & Pipe Wks., Chicago, Ill.

PIPE, STEEL, BUTT AND LAP WELDED
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Rolling Mill Co., The, Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Biggs Boiler Works Co., E. Akron, O.
●Byers Co., A. M., Pittsburgh, Pa.
Chicago Bridge & Iron Co., Chicago, Ill. (Specially fabricated)
Cohoes Rolling Mill Co., Cohoes, N. Y.
●Ellsworth Pipe & Supply Co., Milwaukee, Wis.
Fretz-Moon Tube Co., Butler, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Oil City Tank and Boiler Co., Oil City, Pa.
Pittsburgh Tube Co., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Semet-Solvay Engineering Corp., New York, N. Y. (Specially fabricated)
South Chester Tube Co., Chester, Pa.
●Spang Chalfant, Inc., Div. of National Supply Co., Pittsburgh, Pa.
●Taylor Forge & Pipe Wks., Chicago, Ill.
Tippett & Wood, Phillipsburg, N. J. (12 in. and larger)
Wheatland Tube Co., Philadelphia, Pa.
Wheeling Steel Corp., Wheeling, W. Va.
●Youngstown Sheet & Tube Co., Youngstown, O.

PIPE, STEEL, SEAMLESS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
●Ellsworth Pipe & Supply Co., Milwaukee, Wis.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
●Spang Chalfant, Inc., Div. of National Supply Co., Pittsburgh, Pa.
●Youngstown Sheet & Tube Co., Youngstown, O.

PIPE, STEEL, STAINLESS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Alloy Steel Products Co., Linden, N. J.
American Rolling Mill Co., The, Middletown, O.
Colonial Alloys Co., Metals Div., Philadelphia, Pa.
Globe Steel Tubes Co., Milwaukee, Wis.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.

PIPE, STONEWARE
General Ceramics Co., Keasbey, N. J.
Knight, Maurice A., Akron, O. (Stoneware)
U. S. Stoneware Co., New York, N. Y. (Stoneware)

PIPE SUPPORTS
See Hangers and Supports, Pipe

PIPE TONGS
See Tongs, Pipe

PIPE, TUBING, FITTINGS AND VALVES, CARBON AND GRAPHITE
National Carbon Co., Carbon Sales Div., Cleveland, O.

PIPE, TUBING, FITTINGS AND VALVES, PLASTIC
Continental Diamond Fibre Co., Newark, Del.

PIPE VISES
See Vises, Pipe

PIPE, WOOD
●American District Steam Co., North Tonawanda, N. Y.
Caldwell Co., W. E., Louisville, Ky.
Michigan Pipe Co., Bay City, Mich.
Wyckoff & Son Co., A., Elmira, N. Y.

PIPE WRENCHES
See Wrenches, Pipe

PIPE, WROUGHT IRON
●Byers Co., A. M., Pittsburgh, Pa.
South Chester Tube Co., Chester, Pa.

PISTON RINGS
See Rings, Piston

PITOT TUBES
See Tubes, Pitot

PITTSBURGH LOCK FORMING MACHINES
See Machines, Pittsburgh Lock Forming

PLASTIC PIPE
See Pipe, Tubing, Fittings and Valves, Plastic

PLASTIC TUBING
See Tubing, Plastic

PLATES, FLOOR AND CEILING
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Beaton & Corbin Mfg. Co., Southington, Conn.
Chicago Nipple Mfg. Co., Chicago, Ill.
Farley Sleeve & Hanger Co., Cleveland, O.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
Globe Machine & Stamping Co., Cleveland, O.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Jarecki Mfg. Co., Erie, Pa.
Keeney Mfg. Co., Newington, Conn.
Little Mfg. Co., M. S., Hartford, Conn.
Ravena Iron Co., Ravena, N. Y.
Russell Mfg. Co., John M., Naugatuck, Conn.
Walworth Co., New York, N. Y.

PLUG COCKS
See Valves, Plug

PLUG VALVES
See Valves, Plug

PORTS, OBSERVATION, BOILER
Detroit Stoker Co., Detroit, Mich.
Preferred Utilities Mfg. Corp., New York, N. Y.

POWER SHEARS
See Shears, Power

PREHEATERS, FUEL OIL
●American District Steam Co., North Tonawanda, N. Y.
American Locomotive Co., Alco Products Div., New York, N. Y.
●Bell & Gossett Co., Morton Grove, Ill.
Davis Engineering Corp., Elizabeth, N. J.
●Downingtown Iron Works, Downingtown, Pa.
Engineer Co., New York, N. Y.
Frank Heaters, Inc., Paterson, N. J.
General Fittings Co., Providence, R. I.
Griscom-Russell Co., New York, N. Y.
Heat Transfer Products, Inc., New York, N. Y.
Hynes Electric Heating Co., Camden, N. J.
Johnson Corp., Three Rivers, Mich.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
National Airoil Burner Co., Inc., Philadelphia, Pa.
National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.

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Preferred Utilities Mfg. Corp., New York, N. Y.
Purdue Associates, Inc., Albert G., New Haven, Conn.
Richmond Engineering Co., Inc., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Semet-Solvay Engineering Corp., New York, N. Y.
Sims Co., Erie, Pa.
Standard Heater & Oil Equipment Co., Jersey City, N. J.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Taco Heaters, Inc., New York, N. Y.
Trent Co., Harold E., Philadelphia, Pa.
Vulcan Electric Co., Danvers, Mass.
Warren Electric Appliance Co., Warren, Pa.
●Whitlock Mfg. Co., Hartford, Conn.
●Wiegand Co., Edwin L., Pittsburgh, Pa.
Zallea Brothers & Johnson, Wilmington, Del.

PREHEATERS AND STRESS RELIEVERS, ELECTRIC, FOR PIPE WELDS

Electric Arc, Inc., Newark, N. J.
Kuhlman Electric Co., Detroit Electric Furnace Div., Bay City, Mich.
Swoboda, Inc., H. O., New Brighton, Pa.
Trent Co., Harold E., Philadelphia, Pa.

PRE-INSULATED PIPE

See Pipe, Pre-Insulated

PRESSURE BLOWERS

See Blowers, High Pressure

PRESSURE CONTROLLERS

See Regulators, Pressure

PRESSURE GAGES

See Gages, Indicating, Pressure

PRESSURE INDICATOR-CONTROLLERS

See Indicator-Controllers, Pressure

PRESSURE RECORDER-CONTOLLERS

See Recorder-Controllers, Pressure

PRESSURE RECORDERS

See Recorders, Pressure and Vacuum

PRESSURE REDUCING VALVES

See Valves, Pressure Reducing and Regulating

PRESSURE REGULATING VALVES

See Valves, Pressure Reducing and Regulating

PRESSURE REGULATORS

See Regulators, Pressure

PRESSURE SWITCHES

See Switches, Pressure and Vacuum

PROCESS HEATING SYSTEMS

See Systems, Process Heating, High Temperature

PROCESS STEAM SUPERHEATERS

See Superheaters, Process Steam

PROCESS AND STORAGE TANKS

See Tanks, Process and Storage

PROPELLER FANS

See Fans, Propeller

PROPORTIONING PUMPS

See Pumps, Proportioning

PROTECTIVE COATINGS

See Coatings, Protective, for Metal

PROTECTORS, PIPE COVERING

●American District Steam Co., North Tonawanda, N. Y.
Carpenter & Paterson, Inc., East Boston, Mass.
Cheney Co., Ardmore, Pa.
●Grinnell Co., Inc., Providence, R. I.
●Ric-wiL Co., Cleveland, O.

PSYCHROMETERS, SLING AND HAND ASPIRATED

American Moistening Co., Providence, R. I.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hill, E. Vernon, Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Parks-Cramer Co., Fitchburg, Mass.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Weksler Thermometer Corp., New York, N. Y.

PSYCHROSTATS

See Humidistats

PULLEYS AND SHEAVES, FOR BELT DRIVES

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
Congress Die Casting Div., Congress Tool & Die Co., Detroit, Mich.
Dayton Rubber Mfg. Co., Dayton, O.
Dick Co., Inc., R. & J., Passaic, N. J.
Goldens' Foundry & Machine Co., Columbus, Ga.
Morrison Products, Inc., Cleveland, O.
Rockwood Mfg. Co., Indianapolis, Ind.
Smith, Inc., Winfield H., Springville, N. Y.
Speedmaster Co., The, Des Plaines, Ill.
Swift Mfg. Co., Detroit, Mich. (Cast iron)
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
Utility Fan Corp., Los Angeles, Cal.
Wood's Sons Co., T. B., Chambersburg, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMP BASES

See Bases and Pads, Vibration Isolating

PUMPS, BOILER FEED

Acker Organization, Inc., W. M., Cleveland, O.
Aldrich Pump Co., Allentown, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Aurora Pump Co., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
Berns Specialty Co., Chicago, Ill.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Cissell Mfg. Co., W. M., Louisville, Ky.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
●Dean Bros. Co., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill
Economy Pumps, Inc., Hamilton, O.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Works, Inc., Brooklyn, N. Y.
Foster Wheeler Corp., New York, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Johnson Corp., Three Rivers, Mich.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Lawrence Pump & Engine Co., Lawrence, Mass.
Lecourtenay Co., Newark, N. J.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
●McDonnell & Miller, Chicago, Ill.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Micro-Westco, Inc., Bettendorf, Ia.
Morehead Mfg. Co., Detroit, Mich.
Morris Machine Works, Baldwinsville, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
National Steam Pump Co., Upper Sandusky, O.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Pacific Pump Works, Huntington Park, Cal.
Robbins & Myers, Inc., Springfield, O.
Schaub Engineering Co., Fred H., Chicago, Ill.
Skidmore Corp., St. Joseph, Mich.
Sterling, Inc., Milwaukee, Wis.
Sterling Pump Corp., Hamilton, O.
Swaby Mfg. Co., Chicago, Ill.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Weil Pump Co., Chicago, Ill.
Weinman Pump Co., Columbus, O.
Wilson-Rumsey Plant, K. R., Seneca Falls, N. Y.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CENTRIFUGAL

Aldrich Pump Co., Allentown, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
●Ames Hydrovac Corp., Brooklyn, N. Y.
Aurora Pump Co., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
Barrett, Haentjens & Co., Hazleton, Pa.
Beach-Russ Co., New York, N. Y.
●Bell & Gossett Co., Morton Grove, Ill.
Berns Specialty Co., Chicago, Ill.
Blaisdell Compressor Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Byron Jackson Co., Los Angeles, Cal.
Chain Belt Co., Milwaukee, Wis.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
●Dean Bros. Co., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
De Laval Steam Turbine Co., Trenton, N. J.

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Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
●**Dunham Co., C. A., Chicago, Ill.**
Eastern Engineering Co., New Haven, Conn.
Economy Pumps, Inc., Hamilton, O.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Works, Inc., Brooklyn, N. Y.
Foster Wheeler Corp., New York, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Fulflo Specialties Co., Inc., The, Blanchester, O.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Jackson Co., Byron, Los Angeles, Cal.
Kimball-Krogh Pump Div., Food Machinery Corp., Los Angeles, Cal.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kraissl Co., Inc., The, Hackensack, N. J.
La Bour Co., Inc., The, Elkhart, Ind.
Lawrence Pump & Engine Co., Lawrence, Mass.
Lecourtenay Co., Newark, N. J.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Micro-Westco, Inc., Bettendorf, Ia.
Morris Machine Wks., Baldwinsville, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
●**Nash Engineering Co., South Norwalk, Conn.**
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Pacific Pump Works, Huntington Park, Cal.
Palmer Electric Co., Detroit, Mich.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Quimby Pump Co., Inc., Newark, N. J.
Red Jacket Mfg. Co., Davenport, Ia.
Schneible Co., Claude B., Chicago, Ill.
Schwitzer-Cummins Co., Indianapolis, Ind.
Skidmore Corp., St. Joseph, Mich.
Smith Meter Co., Los Angeles, Cal.
Sterling Pump Corp., Hamilton, O.
Swaby Mfg. Co., Chicago, Ill.
Taber Pump Co., Buffalo, N. Y.
●**Trane Co., La Crosse, Wis.**
Union Steam Pump Co., Battle Creek, Mich.
United Motors Service Co., Detroit, Mich.
Utility Fan Corp., Los Angeles, Cal.
Warren Steam Pump Co., Inc., Warren, Mass.
Weil Pump Co., Chicago, Ill.
Weinman Pump Mfg. Co., Columbus, O.
Wilson-Rumsey Plant, K. R., Seneca Falls, N. Y.
●**Worthington Pump & Machinery Corp., Harrison, N. J.**
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CONDENSATION RETURN

Aldrich Pump Co., Allentown, Pa.
●**Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
American-Marsh Pumps, Inc., Battle Creek, Mich.
●Ames Hydrovac Corp., Brooklyn, N. Y.
Aurora Pump Co., Aurora, Ill.
●**Buffalo Pumps, Inc., Buffalo, N. Y.**
Byron Jackson Co., Los Angeles, Cal.
Chicago Pump Co., Chicago, Ill.
Cissell Mfg. Co., W. M., Louisville, Ky.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
●**Dean Bros. Co., Indianapolis, Ind.**
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
●**Dunham Co., C. A., Chicago, Ill.**
Eastern Engineering Co., New Haven, Conn.
Eclipse Fuel Engineering Co., Rockford, Ill.
Economy Pumps, Inc., Hamilton, O.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Works, Inc., Brooklyn, N. Y.
Foster Wheeler Corp., New York, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Heating Assurance, Inc., Spokane, Wash.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
Ingersoll-Rand, New York, N. Y.
Jackson Co., Byron, Los Angeles, Cal.
Johnson Corp., Three Rivers, Mich.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Lawrence Pump & Engine Co., Lawrence, Mass.
Lecourtenay Co., Newark, N. J.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Micro-Westco, Inc., Bettendorf, Ia.
Morehead Mfg. Co., Detroit, Mich.
Myers & Bro. Co., F. E., The, Ashland, O.
●**Nash Engineering Co., South Norwalk, Conn.**
National Steam Pump Co., Upper Sandusky, O.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Pacific Pump Works, Huntington Park, Cal.
Quimby Pump Co., Inc., Newark, N. J.
Schaub Engineering Co., Fred H., Chicago, Ill.
Skidmore Corp., St. Joseph, Mo.
Sterling, Inc., Milwaukee, Wis.
Sterling Pump Corp., Hamilton, O.
Swaby Mfg. Co., Chicago, Ill.
●**Trane Co., La Crosse, Wis.**
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Weil Pump Co., Chicago, Ill.
Weinman Pump Co., Columbus, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
Wilson-Rumsey Plant, K. R., Seneca Falls, N. Y.
●**Worthington Pump & Machinery Corp., Harrison, N. J.**
Yeomans Bros. Co., Chicago, Ill.

PUMPS, DEEP WELL, TURBINE

American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Aurora Pump Co., Aurora, Ill.
Cook, Inc., A. D., Lawrenceburg, Ind.
Davidson Co., M. T., New York, N. Y.
Deming Co., Salem, O.
Duro Co., Dayton, O.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Kimball-Krogh Pump Div., Food Machinery Corp., Los Angeles, Cal.
Layne & Bowler, Inc., Memphis, Tenn.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Micro-Westco, Inc., Bettendorf, Ia. (Jet type)
Pacific Pump Works, Huntington Park, Cal.
Peerless Pump Div., Food Machinery Corp., Canton, O.
Pomona Pump Co., Pomona, Cal.
Red Jacket Mfg. Co., Davenport, Ia.
Sterling Pump Corp., Hamilton, O.
Uniflow Mfg. Co., Erie, Pa.
Wilson-Rumsey Plant, K. R., Seneca Falls, N. Y.
●**Worthington Pump & Machinery Corp., Harrison, N. J.**

PUMPS, FIRE

●**Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
American-Marsh Pumps, Inc., Battle Creek, Mich.
●**Buffalo Pumps, Inc., Buffalo, N. Y.**
Chicago Pump Co., Chicago, Ill.
Dayton-Dowd Co., Quincy, Ill.
Economy Pumps, Inc., Hamilton, O.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Lecourtenay Co., Newark, N. J.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Morris Machine Wks., Baldwinsville, N. Y.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Pomona Pump Co., Pomona, Cal.
Viking Pump Co., Cedar Falls, Ia.
Warren Steam Pump Co., Inc., Warren, Mass.
Wilson-Rumsey Plant, K. R., Seneca Falls, N. Y.
●**Worthington Pump & Machinery Corp., Harrison, N. J.**

PUMPS, LIQUID REFRIGERANT CIRCULATING

Economy Pumps, Inc., Hamilton, O.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
Pomona Pump Co., Pomona, Cal.
Red Jacket Mfg. Co., Davenport, Ia.
Warren Steam Pump Co., Inc., Warren, Mass.

PUMPS, PROPORTIONING

●**Cochrane Corp., Philadelphia, Pa.**
Dearborn Chemical Co., Chicago, Ill.
Eastern Engineering Co., New Haven, Conn.
Haering Co., Inc., D. W., Chicago, Ill.
Nelson Chemical Pumps, Casper, Wyo.
% Proportioneers, Inc. %, Providence, R. I.
Wallace & Tiernan Co., Inc., Belleville, N. J.

PUMPS, RECIPROCATING

Aldrich Pump Co., Allentown, Pa.
●**Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
Alten's Foundry & Machine Works, Lancaster, O.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
●**Buffalo Pumps, Inc., Buffalo, N. Y.**
Columbus Steam Pump Wks., Columbus, O.
Davidson Co., M. T., New York, N. Y.
●**Dean Bros. Co., Indianapolis, Ind.**
Deming Co., Salem, O.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pumps Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Ingersoll-Rand, New York, N. Y.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.

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National Steam Pump Co., Upper Sandusky, O.
Red Jacket Mfg. Co., Davenport, Ia.
Uniflow Mfg. Co., Erie, Pa.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
●Watson-Stillman Co., Roselle, N. J.
Weinman Pump Co., Columbus, O.
Wilson-Rumsey Plant, K. R., Seneca Falls, N. Y.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, ROTARY

Allen Billmyre Corp., Mamaroneck, N. Y.
American Hard Rubber Co., New York, N. Y. (Hard Rubber)
Beach-Russ Co., New York, N. Y.
Blackmer Pump Co., Grand Rapids, Mich.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Eastern Engineering Co., New Haven, Conn.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., The, Hackensack, N. J.
Lammert & Mann Co., Chicago, Ill.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Martocello & Co., Jos. A., Philadelphia, Pa.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
●Nash Engineering Co., South Norwalk, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Quimby Pump Co., Inc., Newark, N. J.
Red Jacket Mfg. Co., Davenport, Ia.
Robbins & Myers, Inc., Springfield, O.
Roots-Connersville Blower Corp., Connersville, Ind.
Roper Corp., Geo. D., Rockford, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Sundstrand Machine Tool Co., Rockford, Ill.
Taber Pump Co., Buffalo, N. Y.
Trimount Rotary Power Co., East Dedham, Mass.
Tuthill Pump Co., Chicago, Ill.
Viking Pump Co., Cedar Falls, Ia.
Wilson-Rumsey Plant, K. R., Seneca Falls, N. Y.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, STEAM

American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
●Dean Bros. Co., Indianapolis, Ind.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
National Steam Pump Co., Upper Sandusky, O.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Weinman Pump Co., Columbus, O.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, SUMP

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Aurora Pump Co., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pneumatic Tool Co., New York, N. Y.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
Dean Hill Pump Co., Anderson, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
Eastern Engineering Co., New Haven, Conn.
Economy Pumps, Inc., Hamilton, O.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Imperial Brass Mfg. Co., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand, New York, N. Y.
Kimball-Krogh Pump Div., Food Machinery Corp., Los Angeles, Cal.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Lawrence Pump & Engine Co., Lawrence, Mass.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Micro-Westco, Inc., Bettendorf, Ia.
Morris Machine Wks., Baldwinsville, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Penberthy Injector Co., Detroit, Mich.
Pomona Pump Co., Pomona, Cal.
Quimby Pump Co., Inc., Newark, N. J.
Red Jacket Mfg. Co., Davenport, Ia.
Schneible Co., Claude B., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Sterling Pump Corp., Hamilton, O.
Swaby Mfg. Co., Chicago, Ill.
Taber Pump Co., Buffalo, N. Y.
Triplex Heating Specialty Co., Peru, Ind.
Uniflow Mfg. Co., Erie, Pa.
Union Steam Pump Co., Battle Creek, Mich.
Weil Pump Co., Chicago, Ill.
Weinman Pump Co., Columbus, O.
Wilson-Rumsey Plant, K. R., Seneca Falls, N. Y.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros Co., Chicago, Ill.

PUMPS, VACUUM

Allen Billmyre Corp., Mamaroneck, N. Y.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Beach-Russ Co., New York, N. Y.
Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
Chicago Pump Co., Chicago, Ill.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Davidson Co., M. T., New York, N. Y.
●Dean Bros. Co., Indianapolis, Ind.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill,
Domestic Engine & Pump Co., Shippensburg, Pa,
●Dunham Co., C. A., Chicago, Ill.
Economy Pumps, Inc., Hamilton, O.
Eisler Engineering Corp., Newark, N. J.
Elliott Co., Jeanette, Pa.
Foster Pump Works, Inc., Brooklyn, N. Y.
Foster Wheeler Corp., New York, N. Y.
Fuller Co., Catasauqua, Pa.
Gardner-Denver Co., Quincy, Ill.
●General Electric Co., Schenectady, N. Y.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
Ingersoll-Rand, New York, N. Y.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., The, Hackensack, N. J.
Lammert & Mann Co., Chicago, Ill.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
●Nash Engineering Co., South Norwalk, Conn.
National Steam Pump Co., Upper Sandusky, O.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Roots-Connersville Blower Corp., Connersville, Ind.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Skidmore Corp., St. Joseph, Mich.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Sterling, Inc., Milwaukee, Wis.
Trimount Rotary Power Co., East Dedham, Mass.
Union Steam Pump Co., Battle Creek, Mich.
Viking Pump Co., Cedar Falls, Ia.
Weinman Pump Co., Columbus, O.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, VACUUM HEATING

American-Marsh Pumps, Inc., Battle Creek, Mich.
●Ames Hydrovac Corp., Brooklyn, N. Y.
Beach-Russ Co., New York, N. Y.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Works Co., Columbus, O.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Domestic Engine & Pump Co., Shippensburg, Pa.
●Dunham Co., C. A., Chicago, Ill.
Economy Pumps, Inc., Hamilton, O.
Gardner-Denver Co., Quincy, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
Gylstrom Co., O., Milwaukee, Wis.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
Ingersoll-Rand, New York, N. Y.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
●Nash Engineering Co., South Norwalk, Conn.
Roots-Connersville Blower Corp., Connersville, Ind.
Skidmore Corp., St. Joseph, Mich.
Sterling, Inc., Milwaukee, Wis.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Weinman Pump Co., Columbus, O.
Whittington Pump & Engineering Co., Indianapolis, Ind.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, VISCOUS LIQUIDS AND HEAVY MATERIALS

Aldrich Pump Co., Allentown, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
Beach-Russ Co., New York, N. Y.
Blackmer Pump Co., Grand Rapids, Mich.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.

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Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
●Dean Bros. Co., Indianapolis, Ind.
Economy Pumps, Inc., Hamilton, O.
Engineer Co., New York, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Works, Inc., Brooklyn, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Kimball-Krogh Pump Div., Food Machinery Corp., Los Angeles, Cal.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., The, Hackensack, N. J.
Lawrence Pump & Engine Co., Lawrence, Mass.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Morris Machine Wks., Baldwinsville, N. Y.
Quimby Pump Co., Inc., Newark, N. J.
Red Jacket Mfg. Co., Davenport, Ia.
Robbins & Myers, Inc., Springfield, O.
Roots-Connersville Blower Corp., Connersville, Ind.
Roper Corp., Geo. D., Rockford, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Sterling Pump Corp., Hamilton, O.
Taber Pump Co., Buffalo, N. Y.
Tuthill Pump Co., Chicago, Ill.
Union Steam Pump Co., Battle Creek, Mich.
Viking Pump Co., Cedar Falls, Ia.
Warren Steam Pump Co., Inc., Warren, Mass.
Wilson-Rumsey Plant, K. R., Seneca Falls, N. Y.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUNCHES, SHEET METAL

Beatty Machine & Mfg. Co., Hammond, Ind.
Bertsch & Co., Inc., Cambridge City, Ind.
Bliss Co., E. W., Toledo, O.
●Buffalo Forge Co., Buffalo, N. Y.
Callahan Can Machine Co., Inc., Brooklyn, N. Y.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Greenlee Tool Co., Rockford, Ill.
Heartley Machine & Tool Co., Toledo, O.
Hendley & Whittemore Co., Beloit, Wis.
Henry & Wright Mfg. Co., Hartford, Conn.
International Nutyp Tool Co., Oswego, N. Y.
Kidder Mfg. Co., Inc., J. F., Burlington, Vt.
New Albany Machine Mfg. Co., New Albany, Ind.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Parker-Kalon Corp., New York, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Pels & Co., Inc., Henry, New York, N. Y.
Perkins Machine Co., Warren, Mass.
Rock River Machine Co., Inc., Janesville, Wis.
Royersford Foundry & Machine Co., Inc., Royersford, Pa.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Service Machine Co., Elizabeth, N. J.
Swaine Mfg. Co., Fred J., St. Louis, Mo.
Verson Allsteel Press Co., Chicago, Ill.
Whitney Mfg. Co., W. A., Rockford, Ill.
Whitney Metal Tool Co., Rockford, Ill.
Wiedemann Machine Co., Philadelphia, Pa.
Zeh & Hahnemann Co., Newark, N. J.

PURGERS, REFRIGERANT GAS

●Armstrong Machine Works, Three Rivers, Mich.
●Frick Co., Waynesboro, Pa.

RADIATION, CONVECTION TYPE, CAST IRON

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Crane Co., Chicago, Ill.
National Radiator Co., The, Johnstown, Pa.
Pacific Gas Radiator Co., Huntington Park, Cal.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Smith Co., Inc., The, H. B. Westfield, Mass.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Weil-McLain Co., Chicago, Ill.

RADIATION, CONVECTION TYPE, NON-FERROUS

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Bush Mfg. Co., Hartford, Conn.
Commodore Heaters Corp., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
●G. & O. Mfg. Co., New Haven, Conn.
●Grinnell Co., Inc., Providence, R. I.
Kehm Corp., The, Chicago, Ill.
Kramer Trenton Co., Trenton, N. J.
●McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Rome-Turney Radiator Co., Rome, N. Y.
●Shaw-Perkins Mfg. Co., Pittsburgh, Pa.
Super Radiator Corp., Minneapolis, Minn.
●Tilco-Fin Inc., Brooklyn, N. Y.
●Trane Co., La Crosse, Wis.
●Tuttle & Bailey, Inc., New Britain, Conn.
Vapor Car Heating Co., Inc., Chicago, Ill.
Vulcan Radiator Co., Hartford, Conn.
●Webster & Co., Warren, Camden, N. J.
●Young Radiator Co., Racine, Wis.

RADIATION, DIRECT

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Burnham Boiler Corp., Irvington, N. Y.
Clow & Sons, James B., Chicago, Ill. (Gas fired)
Columbia Radiator Co., McKeesport, Pa.
Crane Co., Chicago, Ill.
Fowler & Wolfe Radiator Co., Norristown, Pa.
International Heater Co., Utica, N. Y.
Kohler Co., Kohler, Wis.
Logansport Radiator Equipment Co., Logansport, Ind.
National Radiator Co., The, Johnstown, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Inc., Frank, Terre Haute, Ind.
Slater Mfg. Co., Wakefield, Mass. (Baseboard)
Smith Co., Inc., H. B., The, Westfield, Mass.
Thatcher Furnace Co., Newark, N. J.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Weil-McLain Co., Chicago, Ill.

RADIATOR AND CONVECTOR HUMIDIFIERS

See Humidifiers for Radiators and Convectors

RADIATOR HANGERS

See Hangers or Brackets, Radiator

RADIATOR ORIFICE VALVES

See Valves, Radiator, Orifice

RADIATOR ORIFICES

See Orifices, Radiator

RADIATOR VALVES

See Valves, Radiator

RADIATORS, HUMIDIFYING

●Burnham Boiler Corp., Irvington, N. Y.
Utica Radiator Corp., Utica, N. Y.

RADIATOR VENT VALVE HUMIDIFIERS

See Humidifiers, Radiator Vent Valve

RATCHET WRENCHES

See Wrenches, Ratchet

REAMERS, PIPE

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Crown Die & Tool Co., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Mueller Co., Decatur, Ill.
Nye Tool & Machine Wks., The, Chicago, Ill.
Toledo Pipe Threading Machine Co., Toledo, O.

RECIPROCATING PUMPS

See Pumps, Reciprocating

RECORDER-CONTROLLERS, COMBINED TEMPERATURE AND HUMIDITY

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
●Powers Regulator Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

RECORDER-CONTROLLERS, HUMIDITY

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
●Powers Regulator Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

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RECORDER-CONTROLLERS, PRESSURE

- American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Bailey Meter Co., Cleveland, O.
- Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Defender Automatic Regulator Co., St. Louis, Mo.
- Foxboro Co., Foxboro, Mass.
- Scientific Instrument Co., Detroit, Mich.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- ●Taylor Instrument Companies, Rochester, N. Y.
- Trerice Co., H. O., Detroit, Mich.
- Wheelco Instrument Co., Chicago, Ill.

RECORDER-CONTROLLERS, TEMPERATURE

- American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Bailey Meter Co., Cleveland, O.
- Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Defender Automatic Regulator Co., St. Louis, Mo.
- Foxboro Co., Foxboro, Mass.
- ●Johnson Service Co., Milwaukee, Wis.
- Leeds & Northrup Co., Philadelphia, Pa.
- Marsh Corp., Jas. P., Chicago, Ill.
- Mason-Neilan Regulator Co., Boston, Mass.
- ●Powers Regulator Co., Chicago, Ill.
- Pyrometer Instrument Co., New York, N. Y.
- Scientific Instrument Co., Detroit, Mich.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- ●Taylor Instrument Companies, Rochester, N. Y.
- Thwing-Albert Instrument Co., Philadelphia, Pa.
- Trerice Co., H. O., Detroit, Mich.
- Wheelco Instruments Co., Chicago, Ill.

RECORDERS, CARBON DIOXIDE

- American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Bailey Meter Co., Cleveland, O.
- Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Defender Automatic Regulator Co., St. Louis, Mo.
- Engelhard, Inc., Charles, Newark, N. J.
- Foxboro Co., Foxboro, Mass.
- ●Hays Corp., Michigan City, Ind.
- Huyette Co., Inc., Paul B., Philadelphia, Pa.
- Leeds & Northrup Co., Philadelphia, Pa.
- Permutit Co., New York, N. Y.
- Precision Control Co., San Francisco, Cal.
- Republic Flow Meters Co., Chicago, Ill.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- Uehling Instrument Co., Paterson, N. J.

RECORDERS, COMBINED TEMPERATURE AND HUMIDITY

- American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Foxboro Co., Foxboro, Mass.
- Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
- Mason-Neilan Regulator Co., Boston, Mass.
- Moeller Instrument Co., Richmond Hill, N. Y.
- ●Powers Regulator Co., Chicago, Ill.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- ●Taylor Instrument Companies, Rochester, N. Y.
- Trerice Co., H. O., Detroit, Mich.

RECORDERS, DRAFT

- American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Bacharach Industrial Instrument Co., Pittsburgh, Pa.
- Bailey Meter Co., Cleveland, O.
- Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Defender Automatic Regulator Co., St. Louis, Mo.
- Foxboro Co., Foxboro, Mass.
- ●Hays Corp., Michigan City, Ind.
- Huyette Co., Inc., Paul B., Philadelphia, Pa.
- Mason-Neilan Regulator Co., Boston, Mass.
- Republic Flow Meters Co., Chicago, Ill.
- Uehling Instrument Co., Paterson, N. J.

RECORDERS, HUMIDITY

- American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Foxboro Co., Foxboro, Mass.
- Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
- H-B Instrument Co., Philadelphia, Pa.
- Leeds & Northrup Co., Philadelphia, Pa.
- Mason-Neilan Regulator Co., Boston, Mass.
- Moeller Instrument Co., Richmond Hill, N. Y.
- ●Powers Regulator Co., Chicago, Ill.
- Scientific Instrument Co., Detroit, Mich.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- ●Taylor Instrument Companies, Rochester, N. Y.
- Trerice Co., H. O., Detroit, Mich.

RECORDERS, LIQUID LEVEL

- American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Bailey Meter Co., Cleveland, O.
- Bristol Co., Waterbury Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
- ●Cochrane Corp., Philadelphia, Pa.
- Foxboro Co., Foxboro, Mass.
- Huyette Co., Inc., Paul B., Philadelphia, Pa.
- Leeds & Northrup Co., Philadelphia, Pa.
- Liquidometer Corp., Long Island City, N. Y.
- Mason-Neilan Regulator Co., Boston, Mass.
- Morey & Jones, Ltd., Los Angeles, Calif.
- Republic Flow Meters Co., Chicago, Ill.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- ●Taylor Instrument Companies, Rochester, N. Y.
- ●Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

RECORDERS, PRESSURE AND VACUUM

- American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Ashton Valve Co., Cambridge, Mass.
- Bacharach Industrial Instrument Co., Pittsburgh, Pa.
- Bailey Meter Co., Cleveland, O.
- Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- ●Cochrane Corp., Philadelphia, Pa.
- Defender Automatic Regulator Co., St. Louis, Mo.
- Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
- Foxboro Co., Foxboro, Mass.
- Leeds & Northrup Co., Philadelphia, Pa.
- Marsh Corp., Jas. P., Chicago, Ill.
- Mason-Neilan Regulator Co., Boston, Mass.
- Moeller Instrument Co., Richmond Hill, N. Y.
- Republic Flow Meters Co., Chicago, Ill.
- Scientific Instrument Co., Detroit, Mich.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- ●Taylor Instrument Companies, Rochester, N. Y.
- Trerice Co., H. O., Detroit, Mich.
- Uehling Instrument Co., Paterson, N. J.
- United States Gauge Co., New York, N. Y.

RECORDERS, TEMPERATURE

- American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Bailey Meter Co., Cleveland, O.
- Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
- ●Cochrane Corp., Philadelphia, Pa.
- Defender Automatic Regulator Co., St. Louis, Mo.
- Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
- Engelhard, Inc., Charles, Newark, N. J.
- Foxboro Co., Foxboro, Mass.
- Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
- H-B Instrument Co., Philadelphia, Pa.
- Leeds & Northrup Co., Philadelphia, Pa.
- Liquidometer Corp., Long Island City, N. Y.
- Marsh Corp., Jas. P., Chicago, Ill.
- Mason-Neilan Regulator Co., Boston, Mass.
- Moeller Instrument Co., Richmond Hill, N. Y.
- Palmer Co., Cincinnati (Norwood), O.
- ●Powers Regulator Co., Chicago, Ill.
- Practical Instrument Co., Chicago, Ill.
- Preferred Utilities Mfg. Corp., New York, N. Y.
- Pyrometer Instrument Co., New York, N. Y.
- Republic Flow Meters Co., Chicago, Ill.
- Scientific Instrument Co., Detroit, Mich.
- Standard Thermometer, Inc., Boston, Mass.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- ●Taylor Instrument Companies, Rochester, N. Y.
- Thwing-Albert Instrument Co., Philadelphia, Pa.
- Trerice Co., H. O., Detroit, Mich.
- Wheelco Instruments Co., Chicago, Ill.

RECORDING THERMOMETERS

See Recorders, Temperature

REDUCERS, SPEED

- ●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- American Pulley Co., Philadelphia, Pa.
- Boston Gear Wks., Inc., North Quincy, Mass.
- De Laval Steam Turbine Co., Trenton, N. J.

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●General Electric Co., Schenectady, N. Y.
Ideal Commutator Dresser Co., Sycamore, Ill.
Janette Mfg. Co., Chicago, Ill. (Motorized)
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Link-Belt Co., Philadelphia, Pa.
Medart Co., St. Louis, Mo.
Moore Steam Turbine Div., Worthington Pump & Machinery Corp., Wellsville, N. Y.
Morse Chain Co., Ithaca, N. Y. (Chain speed)
Philadelphia Gear Works, Inc., Philadelphia, Pa.
Poole Foundry & Machine Co., Baltimore, Md.
Smith, Inc., Winfield H., Springville, N. Y.
Star Electric Motor Co., Bloomfield, N. J.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Westinghouse Electric & Mfg. Co.. East Pittsburgh, Pa.

REFRIGERANT GAS PURGERS

See Purgers, Refrigerant Gas

REFRIGERANTS

Ansul Chemical Co., Marinette, Wis. (methyl chloride, sulphur dioxide)
Armour Ammonia Wks., Chicago, Ill. (ammonia)
Carbide and Carbon Chemicals Corp., New York, N. Y. (Butane, isobutane, propane, ethane)
du Pont de Nemours & Co., Inc., E. I., The, R. & H. Chemicals Dept., Wilmington, Del. (methyl chloride and methylene chloride, SO$_2$, trichlorethylene)
du Pont de Nemours & Co., National Ammonia Div., Frankford, Philadelphia, Pa. (ammonia, sulphur dioxide, methyl chloride, "Freon-12")
Kinetic Chemicals, Inc., Wilmington, Del. ("Freon," fluorine)
Liquid Carbonic Corp., Chicago, Ill. (carbon dioxide)
Monsanto Chemical Co., Organic Chemicals Div., St. Louis, Mo. (Anhydrous Ammonia)
Pennsylvania Salt Mfg. Co., Philadelphia, Pa. (ammonia)
Pure Carbonic, Inc., New York, N. Y. (carbon dioxide)
Solvay Sales Corp., New York, N. Y.
Virginia Smelting Co., West Norfolk, Va. (Methyl chloride, liquid sulphur dioxide, methylene chloride)

REFRIGERATING COMPRESSORS

See Compressors, Refrigerating

REFRIGERATION ACCUMULATORS

See Accumulators, Refrigeration

REFRIGERATION CONTROLS

See Valves, Refrigeration

REFRIGERATION FITTINGS

See Fittings, Refrigeration

REFRIGERATION MANIFOLDS

See Manifolds, Refrigeration

REFRIGERATION VALVES

See Valves, Refrigeration

REGISTERS

Air Control Products, Inc., Muskegon, Mich.
AirO-Fin Register Co., Detroit, Mich.
●Auer Register Co., Cleveland, O.
●Barber-Colman Co., Rockford, Ill.
Best Register Co., Milwaukee, Wis.
Char-Gale Mfg. Co., Minneapolis, Minn.
Diamond Mfg. Co., Wyoming, Pa.
Elsey Metal Specialties Co., Detroit, Mich.
Empire Ventilation Equipment Co., Long Island City, N. Y.
Gillian Mfg. Co., Detroit, Mich.
Hart & Cooley Mfg. Co., Holland, Mich.
Hendrick Mfg. Co., Carbondale, Pa.
●Independent Register Co., Cleveland, O.
Knowles Mushroom Ventilator Co., Montclair, N. J.
Lamneck Products, Inc., Middletown, O.
Middleton Mfg. & Sales Co., Minneapolis, Minn.
●Mueller Furnace Co., L. J., Milwaukee, Wis.
Newman Bros., Inc., Cincinnati, O.
Pacific Gas Radiator Co., Huntington Park, Cal.
Palmer Mfg. Corp., Phoenix, Ariz.
●Register & Grille Mfg. Co., Brooklyn, N. Y.
Roberts-Hamilton Co., Minneapolis, Minn.
Rock Island Register Co., Rock Island, Ill.
Standard Stamping & Perforating Co., Chicago, Ill.
●Tuttle & Bailey, Inc., New Britain, Conn.
United States Register Co., Battle Creek, Mich.
Waterloo Register Co., Waterloo, Ia.

REGULATORS, AIR VELOCITY

●Johnson Service Co., Milwaukee, Wis.
●McDonnell & Miller, Chicago, Ill.
●Powers Regulator Co., Chicago, Ill.

REGULATORS, DAMPER SETS

Adams Co., The, Dubuque, Ia.
Air Control Products, Inc., Muskegon, Mich.
California Cornice, Steel & Supply Corp., Los Angeles, Cal.
●Cole-Sullivan Engineering Co., Minneapolis, Minn.
Fossum, M. H., St. Paul, Minn.
Gerett Corp., M. A., Milwaukee, Wis.
Goese Mfg. Co., Milwaukee, Wis.
Hart & Cooley Mfg. Co., Holland, Mich.
Joal Mfg. Corp., Toledo, O.
Kerentoff, G. L., Cincinnati, O.
Northern Weatherstrip Co., Duluth, Minn.
Ohio Products Co., Cleveland, O.
Parker-Kalon Corp., New York, N. Y.
United States Register Co., Battle Creek, Mich.
Young Regulator Co.. Cleveland. O.

REGULATORS, DRAFT, COMBUSTION

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Askania Regulator Co., Chicago, Ill.
Au-Temp-Co Corp., New York, N. Y.
Automatic Products Co., Milwaukee, Wis.
Bailey Meter Co., Cleveland, O.
Boiler Room Equipment, Inc., New York, N. Y.
Bristol Co., Waterbury, Conn.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burrows Mfg. Co., F. A., York, Pa.
●Cash Co., A. W., Decatur, Ill.
●Cole-Sullivan Engineering Co., Minneapolis, Minn.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Engineer Co., New York, N. Y.
Foster Engineering Co., Newark, N. J.
Foster Wheeler Corp., New York, N. Y.
Foxboro Co., Foxboro, Mass.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hagan Corp., Pittsburgh, Pa.
●Hays Corp., Michigan City, Ind.
Hotstream Heater Co., Cleveland, O.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
Mercoid Corp., The, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Brass Co., Grand Rapids, Mich.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
Precision Control Co., San Francisco, Cal.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Republic Flow Meters Co., Chicago, Ill. (Industrial)
Ruggles-Klingeman Mfg. Co., Salem, Mass.
Russell Electric Co., Chicago, Ill.
Schade Valve Mfg. Co., Philadelphia, Pa.
Shallcross Controls. Inc., Milwaukee, Wis.
Spence Engineering Co., Inc., Walden, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Webster Engineering Co., Tulsa, Okla.

REGULATORS, PRESSURE, AIR

American Meter Co., Inc., New York, N. Y.
Askania Regulator Co., Chicago, Ill.
Atlas Valve Co., Inc., Newark, N. J.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Brooke Engineering Co., Inc., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Cooper Co., Clark, Philadelphia, Pa.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
DeVilbiss Co., The, Toledo, O.
Dockson Corp., Detroit, Mich.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Grove Regulator Co., Oakland, Cal.
Hagan Corp., Pittsburgh, Pa.
Hanlon-Waters, Inc., Tulsa, Okla.
●Illinois Engineering Co., Chicago, Ill.
Keckley Co., O. C., Chicago, Ill.
Klipfel Mfg. Co., Chicago. Ill.
Leslie Co., Lyndhurst, N. J.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
Mercoid Corp., The, Chicago, Ill.
Milburn Co., Alexander, Baltimore, Md.
Modern Engineering Co., St. Louis, Mo.
Monitor Controller Co., The, Baltimore, Md.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Norgren Co., Inc., C. A., Denver, Colo.
Penn Electric Switch Co., Goshen, Ind.
R-S Products Corp., Philadelphia, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Spray Engineering Co., Somerville, Mass.
Square D Co., Detroit, Mich.
Square D Co., Milwaukee, Wis.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.

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- ●Taylor Instrument Companies, Rochester, N. Y.
- Trerice Co., H. O., Detroit, Mich.
- Tryco Products, Inc., Westfield, Mass.
- United Electric Controls Co., Boston, Mass.
- Watson & McDaniel Co., Philadelphia, Pa.
- ●White-Rodgers Electric Co., St. Louis, Mo.

REGULATORS, PRESSURE, GAS

- American Meter Co., Inc., New York, N. Y.
- Askania Regulator Co., Chicago, Ill.
- Atlas Valve Co., Inc., Newark, N. J.
- Barber Gas Burner Co., Cleveland, O.
- Belfield Co., H., Philadelphia, Pa.
- Boylston Steam Specialty Co., Chicago, Ill.
- Bristol Co., Waterbury, Conn.
- Brooke Engineering Co., Inc., Philadelphia, Pa.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Burdett Mfg. Co., Chicago, Ill.
- ●Cash Co., A. W., Decatur, Ill.
- Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
- Cooper Co., Clark, Philadelphia, Pa.
- Davis Regulator Co., Chicago, Ill.
- Defender Automatic Regulator Co., St. Louis, Mo.
- Dockson Corp., Detroit, Mich.
- Eclipse Fuel Engineering Co., Rockford, Ill.
- ●Fisher Governor Co., Marshalltown, Ia.
- Foster Engineering Co., Newark, N. J.
- Fox Control & Mfg. Co., Cleveland, O.
- Foxboro Co., Foxboro, Mass.
- Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
- ●General Controls Co., Glendale, Cal.
- Grove Regulator Co., Oakland, Cal.
- Hagan Corp., Pittsburgh, Pa.
- Hanlon-Waters, Inc., Tulsa, Okla.
- ●Illinois Engineering Co., Chicago, Ill.
- Imperial Brass Mfg. Co., Chicago, Ill.
- Kieley & Mueller, Inc., New York, N. Y.
- Klipfel Mfg. Co., Chicago, Ill.
- Leslie Co., Lyndhurst, N. J.
- Mason-Neilan Regulator Co., Boston, Mass.
- ●McAlear Mfg. Co., Chicago, Ill.
- Mercoid Corp., The, Chicago, Ill.
- Milburn Co., Alexander, Baltimore, Md.
- Modern Engineering Co., St. Louis, Mo.
- Monitor Controller Co., The, Baltimore, Md.
- Mueller Co., Decatur, Ill.
- Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
- Norgren Co., Inc., C. A., Denver, Col.
- Pacific Gas Radiator Co., Huntington Park, Cal.
- Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
- Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
- ●Powers Regulator Co., Chicago, Ill.
- R-S Products Corp., Philadelphia, Pa.
- ●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
- Republic Flow Meters Co., Chicago, Ill. (Industrial)
- Ruggles-Klingemann Mfg. Co., Salem, Mass.
- Schade Valve Mfg. Co., Philadelphia, Pa.
- Shallcross Controls, Inc., Milwaukee, Wis.
- Spence Engineering Co., Inc., Walden, N. Y.
- Square D Co., Detroit, Mich.
- Staples & Pfeiffer, Ltd., San Francisco, Cal.
- Strong, Carlisle & Hammond Co., The, Cleveland, O.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- ●Taylor Instrument Companies, Rochester, N. Y.
- Trerice Co., H. O., Detroit, Mich.
- Watson & McDaniel Co., Philadelphia, Pa.

REGULATORS, PRESSURE, HOT WATER HEATING SYSTEMS

- Beaton & Cadwell Mfg. Co., New Britain, Conn.
- ●Bell & Gossett Co., Morton Grove, Ill.
- ●Fisher Governor Co., Marshalltown, Ia.
- ●Hoffman Specialty Co., Inc., Indianapolis, Ind.
- Kainer Co., Chicago, Ill.
- Kehm Corp., The, Chicago, Ill.
- ●Maid-O'-Mist, Inc., Chicago, Ill.
- ●McDonnell & Miller, Chicago, Ill.
- Mercoid Corp., The, Chicago, Ill.
- Mueller Co., Decatur, Ill.
- Penberthy Injector Co., Detroit, Mich.
- Schade Valve Mfg. Co., Philadelphia, Pa.
- Taco Heaters, Inc., New York, N. Y.
- Thrush & Co., H. A., Peru, Ind.
- Watts Regulator Co., Lawrence, Mass.
- ●White-Rodgers Electric Co., St. Louis, Mo.

REGULATORS, PRESSURE, LIQUID

- Atlas Valve Co., Inc., Newark, N. J.
- Automatic Control Co., St. Paul, Minn.
- Bailey Meter Co., Cleveland, O.
- Beaton & Cadwell Mfg. Co., New Britain, Conn.
- Belfield Co., H., Philadelphia, Pa.
- Boylston Steam Specialty Co., Chicago, Ill.
- Bristol Co., Waterbury, Conn.
- Brooke Engineering Co., Inc., Philadelphia, Pa.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- ●Cash Co., A. W., Decatur, Ill.
- Cash Universal Regulator Co., Marshalltown, Ia.
- Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
- Cooper Co., Clark, Philadelphia, Pa.
- Davis Regulator Co., Chicago, Ill.
- Defender Automatic Regulator Co., St. Louis, Mo.
- ●Fisher Governor Co., Marshalltown, Ia.
- Foster Engineering Co., Newark, N. J.
- Foxboro Co., Foxboro, Mass.
- ●Fulton Sylphon Co., Knoxville, Tenn.
- General Sales & Products Co., Cohoes, N. Y.
- Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
- Grove Regulator Co., Oakland, Cal.
- Hagan Corp., Pittsburgh, Pa.
- Hanlon-Waters, Inc., Tulsa, Okla.
- Healy Ruff Co., St. Paul, Minn.
- ●Illinois Engineering Co., Chicago, Ill.
- ●Johnson Service Co., Milwaukee, Wis.
- Justus Steam Trap Co., Napanoch, N. Y.
- Keckley Co., O. C., Chicago, Ill.
- Kieley & Mueller, Inc., New York, N. Y.
- Klipfel Mfg. Co., Chicago, Ill.
- Leslie Co., Lyndhurst, N. J.
- Locke Regulator Co., Salem, Mass.
- Marsh Corp., Jas. P., Chicago, Ill.
- Mason-Neilan Regulator Co., Boston, Mass.
- ●McAlear Mfg. Co., Chicago, Ill.
- ●McDonnell & Miller, Chicago, Ill.
- Mercoid Corp., The, Chicago, Ill.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- Monarch Mfg. Wks., Inc., Philadelphia, Pa.
- Monitor Controller Co., The, Baltimore, Md.
- Mueller Co., Decatur, Ill.
- Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
- Norgren Co., Inc., C. A., Denver, Colo.
- Perfex Corp. (Controls Div.), Milwaukee, Wis.
- ●Powers Regulator Co., Chicago, Ill.
- ●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
- Republic Flow Meters Co., Chicago, Ill.
- Ruggles-Klingemann Mfg. Co., Salem, Mass.
- Sampsel Time Control, Inc., Spring Valley, Ill.
- Schade Valve Mfg. Co., Philadelphia, Pa.
- Schaub Engineering Co., Fred H., Chicago, Ill.
- Shallcross Controls, Inc., Milwaukee, Wis.
- Spence Engineering Co., Inc., Walden, N. Y.
- Square D Co., Detroit, Mich.
- Square D Co., Milwaukee, Wis.
- Staples & Pfeiffer, Ltd., San Francisco, Cal.
- Stickle Steam Specialties Co., Indianapolis, Ind.
- Strong, Carlisle & Hammond Co., The, Cleveland, O.
- Swartwout Co., Cleveland, O.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- ●Taylor Instrument Companies, Rochester, N. Y.
- Trerice Co., H. O., Detroit, Mich.
- Tryco Products, Inc., Westfield, Mass.
- United Electric Controls Co., Boston, Mass.
- Watson & McDaniel Co., Philadelphia, Pa.
- Watts Regulator Co., Lawrence, Mass.
- ●White-Rodgers Electric Co., St. Louis, Mo.
- Williams Gauge Co., Pittsburgh, Pa. (Feed water)

REGULATORS, STATIC PRESSURE, AIR DUCT

- ●Barber-Colman Co., Rockford, Ill.
- Bristol Co., Waterbury, Conn.
- ●Johnson Service Co., Milwaukee, Wis.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- ●Powers Regulator Co., Chicago, Ill.

REGULATORS, TEMPERATURE

- American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
- American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
- Armstrong Heat Control Co., Portland, Ore.
- Atlas Valve Co., Inc., Newark, N. J.
- Au-Temp-Co Corp., New York, N. Y.
- ●Automatic Products Co., Milwaukee, Wis.
- ●Barber-Colman Co., Rockford, Ill.
- Bristol Co., Waterbury, Conn.
- Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
- Burling Instrument Co., Newark, N. J.
- Cook Electric Co., Chicago, Ill.
- Cooper Co., Clark, Philadelphia, Pa.
- Defender Automatic Regulator Co., St. Louis, Mo.
- ●Detroit Lubricator Co., Detroit, Mich.
- ●Dunham Co., C. A., Chicago, Ill.
- Eastern Engineering Co., New Haven, Conn.
- Eclipse Fuel Engineering Co., Rockford, Ill.
- Edison, Inc., Thomas A., Edison Electrical Controls Div., West Orange, N. J.
- Electrimatic Corp., Chicago, Ill.
- Foster Engineering Co., Newark, N. J.
- Foxboro Co., Foxboro, Mass.
- Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
- ●Fulton Sylphon Co., Knoxville, Tenn.
- ●General Controls Co., Glendale, Cal.
- H-B Instrument Co., Philadelphia, Pa.

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Hagan Corp., Pittsburgh, Pa.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Keckley Co., O. C., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Marsh Corp., Jas. P., Chicago, Ill.
Marsh Tritrol Co., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
McCorkle Co., D. H., Berkeley, Cal.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., The, Baltimore, Md.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
●Powers Regulator Co., Chicago, Ill.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Pyrometer Instrument Co., New York, N. Y.
Ranco, Inc., Columbus, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., Inc., New York, N. Y.
Scientific Instrument Co., Detroit, Mich.
Spence Engineering Co., Inc., Walden, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Detroit, Mich.
Sterling, Inc., Milwaukee, Wis.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Triplex Heating Specialty Co., Peru, Ind.
United Electric Controls Co., Boston, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Wheelco Instruments Co., Chicago, Ill.
White Mfg. Co., St. Paul, Minn.
●White-Rodgers Electric Co., St. Louis, Mo.

RELAYS, ELECTRICAL

Advance Electric Co., Los Angeles, Cal.
●Allen-Bradley Co., Milwaukee, Wis.
American Instrument Co., Silver Spring, Md.
Arrow-Hart & Hegeman Elect. Co., Hartford, Conn.
Au-Temp-Co Corp., New York, N. Y.
Automatic Switch Co., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
Bender Warrick Corp., Birmingham, Mich.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Boston Auto Gage Co., Pittsfield, Mass.
Clark Controller Co., Cleveland, O.
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Cook Electric Co., Chicago, Ill.
Cramer Co., Inc., R. W., The, Centerbrook, Conn.
Cutler-Hammer, Inc., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
Dunn, Inc., Struthers, Philadelphia, Pa.
Durakool, Inc., Elkhart, Ind.
Edison, Inc., Thos. A., Edison Electrical Controls Div., West Orange, N. J.
Electric Controller & Mfg. Co., Cleveland, O.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
Guardian Electric Mfg. Co., Chicago, Ill.
H-B Instrument Co., Philadelphia, Pa.
Hart Mfg. Co., Hartford, Conn.
Industrial Engineering Corp., Terre Haute, Ind.
Jefferson Electric Co., Bellwood, Ill.
Magnet Switch Co., Chicago, Ill.
McCorkle Co., D. H., Berkeley, Calif.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., The, Baltimore, Md.
National Time & Signal Corp., Detroit, Mich.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Philadelphia Thermometer Co., Philadelphia, Pa.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Milwaukee, Wis.
Struthers Dunn, Inc., Philadelphia, Pa.
●Taylor Instrument Companies, Rochester, N. Y.
Triplex Heating Specialty Co., Peru, Ind.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electrical Instrument Corp., Newark, N. J.
●White-Rodgers Electric Co., St. Louis, Mo.
Zenith Electric Co., Chicago, Ill.

RELIEF VALVES

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REPAIR CLAMPS

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RESEATERS, VALVE

Leavitt Machine Co., Orange, Mass.
Standard Reseater Corp., New York, N. Y.

RINGS, PISTON, FOR COMPRESSORS

American Hammered Piston Ring Div., Koppers Co., Baltimore, Md.
McQuay-Norris Mfg. Co., St. Louis, Mo.
Perfect Circle Co., The, Hagerstown, Ind.
Perfection Refrigeration Parts Co., Harvey, Ill.
Sealed Power Corp., Muskegon, Mich.

RINGS, WELDING

●Tube-Turns, Louisville, Ky.

ROD, GAS WELDING

●Air Reduction Sales Co., New York, N. Y.
American Agile Corp., Cleveland, O.
●American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Cleveland, O.
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Steel & Wire Co., Chicago, Ill.
Crucible Steel Co. of America, New York, N. Y.
Duraloy Co., Scottdale, Pa. (Stainless)
Imperial Brass Mfg. Co., Chicago, Ill.
International Nickel Co., New York, N. Y.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Maurath, Inc., Cleveland, O.
Milburn Co., Alexander, Baltimore, Md.
Modern Engineering Co., St. Louis, Mo.
National Cylinder Gas Co., Chicago, Ill.
Page Steel & Wire Division of American Chain & Cable Co., Inc., Monessen, Pa.
Republic Steel Corp., Cleveland, O.
Revere Copper and Brass, Incorporated, New York, N. Y.
Roebling's Sons, John A., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Torchweld Equipment Div., National Cylinder Gas Co., Chicago, Ill.
Universal Power Corp., Cleveland, O.
Walworth Co., New York, N. Y.
Wickwire Spencer Steel Co., New York, N. Y.
●Youngstown Sheet & Tube Co., Youngstown, O.

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ROOF COOLERS

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ROOF SPRAYING SYSTEMS

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RUBBER PIPE

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SADDLE VALVES

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SAFETY VALVES

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SCREENS, SUN REFLECTING

●Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago, Ill.

SEAMLESS PIPE

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SEPARATORS, AIR

Adams Co., Inc., R. P., Buffalo, N. Y.
American Injector Co., Detroit, Mich.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Centrifix Corp., Cleveland, O.
Crane Co., Chicago, Ill.
DeVilbiss Co., The, Toledo, O.
Hagan Corp., Pittsburgh, Pa.

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●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
Keckley Co., O. C., Chicago, Ill.
Leavitt Machine Co., Orange, Mass.
Logan Engineering Co., Chicago, Ill.
Milburn Co., Alexander, Baltimore, Md.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Spencer Turbine Co., Hartford, Conn.
Spray Engineering Co., Somerville, Mass.
●Staynew Filter Corp., Rochester, N. Y.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Textite Corp., Chicago, Ill.
Trerice Co., H. O., Detroit, Mich.
Wright-Austin Co., Detroit, Mich.

SEPARATORS, STEAM AND OIL

Acme Industries, Inc., Jackson, Mich.
Adams Co., Inc., R. P., Buffalo, N. Y.
●American District Steam Co., North Tonawanda, N. Y.
Barrett Machine Co., N. S., Pittsburgh, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Centrifix Corp., Cleveland, O.
●Cochrane Corp., Philadelphia, Pa.
Crane Co., Chicago, Ill.
Elliott Co., Jeannette, Pa.
●Fisher Governor Co., Marshalltown, Ia.
●Frick Co., Waynesboro, Pa.
Hagan Corp., Pittsburgh, Pa.
Hoppes Mfg. Co., Springfield, O.
●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
Kieley & Mueller, Inc., New York, N. Y.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Logan Engineering Co., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
Morehead Mfg. Co., Detroit, Mich.
National Valve & Mfg. Co., Pittsburgh, Pa.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Richmond Engineering Co., Inc., Richmond, Va.
Schutte & Koerting Co., Philadelphia, Pa.
Sims Co., Erie, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Textite Corp., Chicago, Ill.
●Webster & Co., Warren, Camden, N. J.
Westfalia Separator Co., Bloomfield, N. J.
Wright-Austin Co., Detroit, Mich.

SEWAGE EJECTORS

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SHEARS, ELECTRIC, PORTABLE

Black & Decker Mfg. Co., Towson, Md.
G. D. S. Machinery & Supply Co., Inc., New York, N. Y.
Independent Pneumatic Tool Co., Chicago, Ill.
●O'Neil-Irwin, Inc., Minneapolis, Minn.
Skilsaw, Inc., Chicago, Ill.
Stanley Electric Tool Div., The Stanley Works, New Britain, Conn.
Van Dorn Electric Tool Co., Towson, Md.

SHEARS, POWER

Beatty Machine & Mfg. Co., Hammond, Ind.
Bertsch & Co., Inc., Cambridge City, Ind.
Bliss Co., E. W., Toledo, O.
●Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Heartley Machine & Tool Co., Toledo, O.
Hendley & Whittemore, Beloit, Wis.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Quickwork-Whiting Div. of Whiting Corp., Harvey, Ill.
Rafter Machine Co., Belleville, N. J.
Rock River Machine Co., Inc., Janesville, Wis.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Yoder Co., The, Cleveland, O.

SHEARS AND SNIPS, HAND

Armstrong-Blum Mfg. Co., Chicago, Ill.
Bartlett Mfg. Co., Detroit, Mich.
Beverly Throatless Shear Co., Chicago, Ill.
Bremil Mfg. Co., Erie, Pa.
Clauss Shear Co., Fremont, O.
Crescent Tool Co., Jamestown, N. Y.
Excelsior Tool & Machine Co., East St. Louis, Ill.
G. D. S. Machinery & Supply Co., Inc., New York, N. Y.
Grobet File Corp. of America, New York, N. Y.
Hendley & Whittemore, Beloit, Wis.
Kidder Mfg. Co., Inc., J. F., Burlington, Vt. (Angle)
Marshalltown Mfg. Co., Marshalltown, Ia.
Niagara Machine & Tool Wks., Buffalo, N. Y.
●O'Neil-Irwin, Inc., Minneapolis, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Rafter Machine Co., Belleville, N. J.
Viking Shear Co., Erie, Pa.
Whitney Metal Tool Co., Rockford, Ill.
Wiss & Sons Co., J., Newark, N. J.

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SHEET METAL FITTINGS

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SHEET METAL PUNCHES

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SHEETS, ALUMINUM

Aluminum Co. of America, Pittsburgh, Pa.
American Nickeloid Co., Peru, Ill. (Nickel and chromium plated)
Fairmont Aluminum Co., Fairmont, W. Va.

SHEETS, CLAD

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Aluminum Co. of America, Pittsburgh, Pa.
General Plate Div., Metals & Controls Corp., Attleboro, Mass.
●Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago, Ill.
Jessop Steel Co., Washington, Pa.
Lukens Steel Co., Coatesville, Pa.

SHEETS, COPPER

●American Brass Co., Waterbury, Conn.
American Nickeloid Co., Peru, Ill. (Nickel and chromium plated)
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Conklin Brass & Copper Co., Inc., T. E., New York, N. Y.
Downs-Smith Brass & Copper Co., New York, N. Y.
●Hussey & Co., C. G., Pittsburgh, Pa.
National Brass & Copper Co., Inc., Lisbon, O.
New Haven Copper Co., Seymour, Conn.
Revere Copper and Brass, Incorporated, New York, N. Y.
United States Brass & Copper Co., Hyde Park, Boston, Mass.

SHEETS, LEAD

Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
Andrews Lead Co., Inc., Long Island City, N. Y.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.
Rochester Lead Wks., Rochester, N. Y.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

SHEETS, NICKEL AND NICKEL ALLOY

American Nickeloid Co., Peru, Ill.
International Nickel Co., New York, N. Y.
Republic Steel Corp., Cleveland, O.
Revere Copper and Brass Incorporated, New York, N. Y.

SHEETS, STEEL, COPPER BEARING

American Rolling Mill Co., The, Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Columbia Steel Co. (Sub. United States Steel Corp.), San Francisco, Cal.
Continental Steel Corp., Kokomo, Ind.
Follansbee Steel Corp., Pittsburgh, Pa.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Lukens Steel Co., Coatesville, Pa.
Newport Rolling Mill Co., Div. of The Andrews Steel Co., Newport, Ky.
Reeves Steel & Mfg. Co., Dover, O.
Republic Steel Corp., Cleveland, O.
Sharon Steel Corp., Sharon, Pa.
Superior Sheet Steel Co., The, Canton, O.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Wheeling Corrugating Co., Wheeling, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
●Youngstown Sheet & Tube, Co., Youngstown, O.

SHEETS, STEEL, GALVANIZED

American Rolling Mill Co., The, Middletown, O.
Apollo Steel Co., Apollo, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.

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Columbia Steel Co. (Sub. United States Steel Corp.), San Francisco, Cal.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, New York, N. Y.
Empire Sheet & Tin Plate Co., Mansfield, O.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Detroit, Mich.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Lukens Steel Co., Coatesville, Pa.
Lyon, Conklin & Co., Inc., Baltimore, Md.
Newport Rolling Mill Co., Div. of The Andrews Steel Co., Newport, Ky.
Niles Rolling Mill Co., Niles, O.
Parkersburg Iron & Steel Co., Parkersburg, W. Va.
Reeves Steel & Mfg. Co., Dover, O.
Republic Steel Corp., Cleveland, O.
Sharon Steel Corp., Sharon, Pa.
Superior Sheet Steel Co., The, Canton, O.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Wheeling Corrugating Co., Wheeling, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
●Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS, STEEL, GALVANNEALED

Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Newport Rolling Mill Co., Div. of The Andrews Steel Co., Newport, Ky.
Republic Steel Corp., Cleveland, O.
Sharon Steel Corp., Sharon, Pa.
Superior Sheet Steel Co., The, Div. of Continental Steel Corp., Canton, O.
●Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS, STEEL, STAINLESS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Rolling Mill Co., The, Middletown, O.
Barium Stainless Steel Corp., Canton, O.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Colonial Alloys Co., Metals Div., Philadelphia, Pa.
●Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago, Ill.
Jessop Steel Co., Washington, Pa.
Lukens Steel Co., Coatesville, Pa.
Republic Steel Corp., Cleveland, O.
Ryerson & Son, Inc., Jos. T., Chicago, Ill.
Sharon Steel Corp., Sharon, Pa.
Superior Steel Corp., Pittsburgh, Pa.
Universal-Cyclops Steel Corp., Bridgeville, Pa.

SHEETS, WROUGHT IRON

●Byers Co., A. M., Pittsburgh, Pa.

SHEETS, ZINC

American Nickeloid Co., Peru, Ill. (Nickel and chromium plated)
American Zinc Products Co., Greencastle, Ind.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Hegeler Zinc Co., Danville, Ill.
Illinois Zinc Co., Chicago, Ill.
Matthiessen & Hegeler Zinc Co., La Salle, Ill.
New Jersey Zinc Sales Co., New York, N. Y.

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SIGHT GLASSES

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SMOKE GUNS

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SMUDGE POTS

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SOCKET WRENCHES

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SOLAR HEAT RESISTING SCREENS

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SOLDER, BRAZING ALLOYS, AND FLUXES

●Air Reduction Sales Co., New York, N. Y.
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
●American Brass Co., Waterbury, Conn.
●American Solder & Flux Co., Philadelphia. Pa.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Benson Co., Inc., Alex R., Hudson, N. Y.
Burnley Battery & Mfg. Co., North East, Pa.
Eagle-Picher Lead Co., Cincinnati, O.
Gardiner Metal Co., Chicago, Ill.
General Plate Div., Metals & Controls Corp., Attleboro, Mass.
Glaser Lead Co., Inc., Brooklyn, N. Y.
Handy & Harman, New York, N. Y. (Silver)
Hardy, Inc., Charles, New York, N. Y.
Imperial Brass Mfg. Co., Chicago, Ill.
Industrial Service Laboratories, Milwaukee, Wis.
Kester Solder Co., Chicago, Ill.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.
Ruby Chemical Co., Columbus, O.
Ryerson & Son, Inc., Jos. T., Chicago, Ill.
Torchweld Equipment Div., National Cylinder Gas Co., Chicago, Ill.
Utility Laboratory, Inc., Brooklyn, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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SPRAY HUMIDIFIERS

See Humidifiers, Direct, Spray Head

SPRAY NOZZLES

See Nozzles, Spray

SPRAY PAINTING BOOTHS

See Booths, Painting, Spray

SPRINKLER HEADS

See Heads, Sprinkler

SPRINKLER SYSTEM CONTROLS

See Controls, Sprinkler System; Valves, Sprinkler System Control

STAINLESS STEEL PIPE

See Pipe, Steel, Stainless

STAINLESS STEEL SHEETS

See Sheets, Steel, Stainless

STANDS, PIPE VISE

American Pipe Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Crown Die & Tool Co., Chicago, Ill.
Hollands Mfg. Co., Erie, Pa.
Martin & Sons, H. P., Owensboro, Ky.
Nye Tool & Machine Wks., The, Chicago, Ill.
Ridge Tool Co., Elyria, O.
Toledo Pipe Threading Machine Co., Toledo, O.
Western Wire Products Co., St. Louis, Mo.
●Williams & Co., J. H., New York, N. Y.

STEAM BOOSTER COMPRESSORS

See Compressors, Steam Booster

STEAM ENGINES

See Engines, Steam

STEAM JET REFRIGERATION

See Compressors, Refrigerating, Steam Jet

STEAM PRESSURE REGULATORS

See Valves, Pressure Reducing and Regulating

STEAM PUMPS

See Pumps, Steam

STEAM SEPARATORS

See Separators, Steam and Oil

STEAM TRAPS

See Traps, Steam

STEEL PIPE

See Pipe, Steel

STEEL TUBING

See Tubing, Steel

STEEL UNIONS

See Unions, Steel

STEEL VALVES

See Valves, Gate; and Valves, Globe

STERILIZING LAMPS

See Lamps, Sterilizing, for Duct Installation

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STOCKS AND DIES

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Champion Blower & Forge Co., Lancaster, Pa.
Crown Die & Tool Co., Chicago, Ill.
Erie Tool Wks., Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hollands Mfg. Co., Erie, Pa.
Jarecki Mfg. Co., Erie, Pa.
Nye Tool & Machine Wks., The, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Ridge Tool Co., Elyria, O.
Toledo Pipe Threading Machine Co., Toledo, O.
Walworth Co., New York, N. Y.

STOKERS, INDUSTRIAL AND COMMERCIAL

61 to 1200 Lb per Hr

American Coal Burner Co., Chicago, Ill.
American Engineering Co., Philadelphia, Pa.
Anchor Stove & Range Co., New Albany, Ind.
Auburn Foundry, Inc., Stoker Div., Auburn, Ind.
Automatic Stoker Corp., Milwaukee, Wis.
Babcock & Wilcox Co., New York, N. Y.
Bluffton Mfg. Co., The, Findlay, O.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
Burke Stoker & Mfg. Co., Chicago, Ill.
Burnham Stoker Co., Vancouver, Wash.
Butler Street Foundry & Iron Co., Chicago, Ill.
Canton Stoker Corp., Canton, O.
Carnes, Inc., John R., Lima, O.
Chesapeake & Ohio R. R. Co., Cleveland, O.
Clizbe Bros. Mfg. Co., Plymouth, Ind.
Columbus Metal Products, Inc., Columbus, O.
Combustion Engineering Co., Inc., New York, N. Y.
Crown Iron Works, Minneapolis, Minn.
Delta Stoker Co., North Chicago, Ill.
Detroit Stoker Co., Detroit, Mich.
Econocol Stoker Div. of Cotta Transmission Corp., Rockford, Ill.
Eddy Stoker Corp., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Firemood Machine Wks., Converse, Ind.
Flynn & Emrich Co., Baltimore, Md.
Frederick Iron & Steel Co., Frederick, Md.
Fuel Savers, Inc., Harrisburg, Pa.
Gehl Bros. Mfg. Co., West Bend, Wis.
General Machinery Co., Spokane, Wash.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Heating Assurance, Inc., Spokane, Wash.
Her-Born Engrg. & Mfg. Co., Sandusky, O.
Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.
Hoffman Combustion Engineering Co., Detroit, Mich.
Holcomb & Hoke Mfg. Co., Indianapolis, Ind.
Illinois Iron & Bolt Co., Chicago, Ill.
International Engineering Wks., Inc., Framingham, Mass.
Iron Fireman Mfg. Co., Cleveland, O.
Johnston & Jennings Co., Cleveland, O.
Kingston Products Corp., Kokomo, Ind.
Kol-Master Corp., Oregon, Ill.
Laclede Stoker Co., St. Louis, Mo.
Leffel & Co., Springfield, O.
Link-Belt Co., Chicago, Ill.
"Loyal Knight" Stokers, Inc., Belleville, Ill.
Mallory Sales Co., Dolton, Ill.
Muncie Gear Wks., Inc., Muncie, Ind.
National Steam Pump Co., Upper Sandusky, O.
Neemes Foundry, Inc., Troy, N. Y.
Northern Steel and Stoker Co., Peoria, Ill.
Ormsby-Osterman Co., St. Louis, Mo.
Orr & Sembower, Inc., Reading, Pa.
Perfection Grate & Stoker Co., Springfield, Mass.
Riley Stoker Corp., Worcester, Mass.
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Schwitzer-Cummins Co, Indianapolis, Ind.
Scott-Newcomb, Inc., St. Louis, Mo.
Sinker-Davis Co., Indianapolis, Ind.
Standard Stoker Corp., The, New Albany, N. Y.
Steel Products Engineering Co., Springfield, O.
Stok-A-Fire Co., University City, Mo.
Stokermatic Co., Salt Lake City, Utah.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Whiting Stoker Co., Chicago, Ill.
Will-Burt Co., The Orrville, O.

STONEWARE PIPE

See Pipe, Stoneware

STORAGE WATER HEATERS

See Heaters, Water, Steam, Storage

STRAINERS, PIPE LINE

Alten's Foundry & Machine Works, Lancaster, O.
●American District Steam Co., North Tonawanda, N. Y.
American Injector Co., Detroit, Mich.
●Anderson Co., V. D., The, Cleveland, O.
●Automatic Products Co., Milwaukee, Wis.
Barrett, Haentjens & Co., Hazleton, Pa.
●Bishop & Babcock Mfg. Co., Cleveland, O.
Blackmer Pump Co., Grand Rapids, Mich.
Boylston Steam Specialty Co., Chicago, Ill.
Buffalo Meter Co., Buffalo, N. Y.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Cashin Co., W. D., Boston, Mass.
Central Brass Mfg. Co., Cleveland, O.
Crane Co., Chicago, Ill.
Cuno Engineering Corp., Meriden, Conn.
Davis Regulator Co., Chicago, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Elliott Co., Jeannette, Pa.
●Fisher Governor Co., Marshalltown, Ia.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Foster Engineering Co., Newark, N. J.
Foster Pump Works, Inc., Brooklyn, N. Y.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
●Grinnell Co., Providence, R. I.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kaye & MacDonald, Inc., West Orange, N. J.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, New York, N. Y.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., The, Hackensack, N. J.
Leslie Co., Lyndhurst, N. J.
●Maid-O'-Mist, Inc., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
●Mueller Brass Co., Port Huron, Mich.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Long Island City, N. Y.
Newark Wire Cloth Co., Newark, N. J.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Phillips & Co., H. A., Chicago, Ill.
Preferred Utilities Mfg. Corp., New York, N. Y.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., New York, N. Y.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co.. Philadelphia, Pa.
Scientific Instrument Co., Detroit, Mich.
Sheffler-Gross Co., Philadelphia, Pa.
Spence Engineering Co., Walden, N. Y.
Spray Engineering Co., Somerville, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Sterling, Inc., Milwaukee, Wis.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
●Trane Co., La Crosse, Wis.
Trimount Rotary Power Co., East Dedham, Mass.
Tryco Products, Inc., Westfield, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Worthington-Gamon Meter Co., Harrison, N. J.
Wright-Austin Co., Detroit, Mich.
●Yarnall-Waring Co., Philadelphia, Pa.

STRESS RELIEVERS

See Preheaters and Stress Relievers, Electric, for Pipe Welds

STRIP HEATERS

See Heaters, Strip and Immersion, Electric

STRUCTURAL SHAPES

See Angles, Bars, Beams, Channels and Tees

SUMP PUMPS

See Pumps, Sump

SUPERHEATERS, PROCESS STEAM

●Bell & Gossett Co., Morton Grove, Ill.
Edge Moore Iron Works, Inc., New York, N. Y.
Foster Wheeler Corp., New York, N. Y.
Johnston Bros., Inc., Ferrysburg, Mich.
●Marley Co., Kansas City, Kan.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Selas Co., The, Philadelphia, Pa.

SURFACE, FINNED, COOLING, BRINE

Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
American Coils, Inc., Newark, N. J.
Baltimore Air Coil Co., Baltimore, Md.
Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
●Bush Mfg. Co., Hartford, Conn.

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Conditionaire Unit Co., Chicago, Ill.
Drayer & Hanson, Inc., Los Angeles, Cal.
●G. & O. Mfg. Co., New Haven, Conn.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Griscom-Russell Co., The, New York, N. Y.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kramer Trenton Co., Trenton, N. J.
●Marlo Coil Co., St. Louis, Mo.
●McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
●Murray Mfg. Co., D. J., Wausau, Wis.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
●Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Wolverine Tube Co., Detroit, Mich.
XL Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

SURFACE, FINNED, COOLING, COLD WATER

Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
Airtemp, Div. of Chrysler Corp., Dayton, O.
American Coils, Inc., Newark, N. J.
Baltimore Air Coil Co., Baltimore, Md.
Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
●Bush Mfg. Co., Hartford, Conn.
Campbell Heating Co., E. K., Kansas City, Mo.
Conditionaire Unit Co., Chicago Ill.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Foster Wheeler Corp., New York, N. Y.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●G. & O. Mfg. Co., New Haven, Conn.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Griscom-Russell Co., The, New York, N. Y.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Johnson Fan & Blower Corp., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
Larkin Coils, Inc., Atlanta, Ga.
Manufacturers Fin Coil Co., Chicago, Ill.
●Marlo Coil Co., St. Louis, Mo.
●McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Mojonnier Bros. Co., Chicago, Ill.
●Murray Mfg. Co., D. J., Wausau, Wis.
●Nesbitt, Inc., John J., Philadelphia, Pa.
Palmer Mfg. Corp., Phoenix, Ariz.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Standard Galvanizing Co., Chicago, Ill.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Tenney Engineering, Inc., Bloomfield, N. J.
●Tilco-Fin Inc., Brooklyn, N. Y.
●Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
●Wing Mfg. Co., L. J., New York, N. Y.
Wolverine Tube Co., Detroit, Mich.
X L Refrigerating Co., Chicago, Ill.
Yates-American Machine Co., Beloit, Wis.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

SURFACE, FINNED, COOLING, DIRECT EXPANSION

Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
Airtemp, Div. of Chrysler Corp., Dayton, O.
American Coils, Inc., Newark, N. J.
Baltimore Air Coil Co., Baltimore, Md.
Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
●Bush Mfg. Co., Hartford, Conn.
Conditionaire Unit Co., Chicago, Ill.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●G. & O. Mfg. Co., New Haven, Conn.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Griscom-Russell Co., The, New York, N. Y.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
Larkin Coils, Inc., Atlanta, Ga.
Manufacturers Fin Coil Co., Chicago, Ill.
●Marlo Coil Co., St. Louis, Mo.
●McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Mojonnier Bros. Co., Chicago, Ill.
●Murray Mfg. Co., D. J., Wausau, Wis.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Standard Galvanizing Co., Chicago, Ill.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Tenney Engineering, Inc., Bloomfield, N. J.
●Tilco-Fin Inc., Brooklyn, N. Y.
●Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Wolverine Tube Co., Detroit, Mich.
X L Refrigerating Co., Chicago, Ill.
Yates-American Machine Co., Beloit, Wis.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

SURFACE, FINNED, HEATING, INDIRECT, FERROUS

●Airtherm Mfg. Co., St. Louis, Mo.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Bayley Blower Co., Milwaukee, Wis.
Foster Wheeler Corp., New York, N. Y.
Griscom-Russell Co., The, New York, N. Y.
●Murray Mfg. Co., D. J., Wausau, Wis.
New York Blower Co., Chicago, Ill.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Tenney Engineering, Inc., Bloomfield, N. J.
Wolff & Munier, Inc., New York, N. Y. (For panel heating)

SURFACE, FINNED, HEATING, INDIRECT, NON-FERROUS

●Aerofin Corp., Syracuse, N. Y.
●Airtherm Mfg. Co., St. Louis, Mo.
American Coils, Inc., Newark, N. J.
Bayley Blower Co., Milwaukee, Wis.
Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
●Bush Mfg. Co., Hartford, Conn.
Campbell Heating Co., E. K., Kansas City, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Foster Wheeler Corp., New York, N. Y.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●G. & O. Mfg. Co., New Haven, Conn.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
Griscom-Russell Co., The, New York, N. Y.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Johnson Fan & Blower Corp., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
Manufacturers Fin Coil Co., Chicago, Ill.
●Marlo Coil Co., St. Louis, Mo.
●McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
●Murray Mfg. Co., D. J., Wausau, Wis.
●Nesbitt, Inc., John J., Philadelphia, Pa.
Niagara Blower Co., New York, N. Y.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Tenney Engineering, Inc., Bloomfield, N. J.
●Tilco-Fin Inc., Brooklyn, N. Y.
●Trane Co., La Crosse, Wis.
●Wing Mfg. Co., L. J., New York, N. Y.
Wolverine Tube Co., Detroit, Mich.
Yates-American Machine Co., Beloit, Wis.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

SURFACE THERMOSTATS

See Thermostats, Surface

SWING JOINTS

See Joints, Flexible Swing

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SWITCHES, ELECTRICAL

Adam Electric Co., Frank, St. Louis, Mo.
●Allen-Bradley Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Elect. Co., Hartford, Conn
Automatic Switch Co., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Clark Controller Co., Cleveland, O.
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
Delta-Star Electric Co., Chicago, Ill.
Dunn, Inc., Struthers, Philadelphia, Pa.
Electric Controller & Mfg. Co., Cleveland, O.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
Hart Mfg. Co., Hartford, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Micro Switch Corp., Freeport, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., The, Baltimore, Md.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Square D Co., Detroit, Mich.
Square D Co., Milwaukee, Wis.
Struthers Dunn, Inc., Philadelphia, Pa.
Tork Clock Co., Inc., Mount Vernon, N. Y.
Trumbull Electric Mfg. Co., Plainville, Conn.
●Ward Leonard Electric Co., Mount Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
White Mfg. Co., St. Paul, Minn.
●White-Rodgers Electric Co., St. Louis, Mo.

SWITCHES, FLOAT, REFRIGERATION

●Alco Valve Co., St. Louis, Mo.
Clark Controller Co., Cleveland, O.
●Frick Co., Waynesboro, Pa.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., The, Chicago, Ill.
Schaub Engineering Co., Fred H., Chicago, Ill.
Square D Co., Milwaukee, Wis.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.

SWITCHES, FLOW

●McDonnell & Miller, Chicago, Ill.

SWITCHES, LIQUID LEVEL

●Allen-Bradley Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Elect. Co., Hartford, Conn.
Automatic Control Co., St. Paul, Minn.
Bender Warrick Corp., Birmingham, Mich.
Bennett Co., Omaha, Neb.
Cissell Mfg. Co., W. M., Louisville, Ky.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
Hart Mfg. Co., Hartford, Conn.
Healy Ruff Co., St. Paul, Minn.
Kisco Boiler & Engineering Co., St. Louis, Mo.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., The, Baltimore, Md.
Penn Electric Switch Co., Goshen, Ind.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schaub Engineering Co., Fred H., Chicago, Ill.
Square D Co., Detroit, Mich.
Square D Co., Milwaukee, Wis.
Trumbull Electric Mfg. Co., Plainville, Conn.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SWITCHES, MERCURY

Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Durakool, Inc., Elkhart, Ind.
General Electric Co., Lamp Dept., Nela Park, Cleveland, O.
Hart Mfg. Co., Hartford, Conn.
Jefferson Electric Co., Bellwood, Ill.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

SWITCHES, PRESSURE AND VACUUM

●Allen-Bradley Co., Milwaukee, Wis.
Au-Temp-Co Corp., New York, N. Y.
Automatic Control Co., St. Paul, Minn.
Boston Auto Gage Co., Pittsfield, Mass.
Clark Controller Co., Cleveland, O.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
Marsh Corp., Jas. P., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., The, Baltimore, Md.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Detroit, Mich.
Square D Co., Milwaukee, Wis.
Uniflow Mfg. Co., Erie, Pa.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●White-Rodgers Electric Co., St. Louis, Mo.

SWITCHES, TIME

Au-Temp-Co Corp., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
Cooper Co., Clark, Philadelphia, Pa.
Cramer Co., Inc., R. W., The, Centerbrook, Conn.
●Detroit Lubricator Co., Detroit, Mich.
Edison, Inc., Thomas A., Edison Electrical Controls Div., West Orange, N. J.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
Guardian Electric Mfg. Co., Chicago, Ill.
Industrial Engineering Corp., Terre Haute, Ind.
International Register Co., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Time & Signal Corp., Detroit, Mich.
Paragon Electric Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Reliance Automatic Lighting Co., Racine, Wis.
Rhodes, Inc., M. H., Hartford, Conn.
Sampsel Time Control, Inc., Spring Valley, Ill.
Sangamo Electric Co., Springfield, Ill.
Spencer Thermostat Co., Attleboro, Mass.
Tork Clock Co., Inc., Mount Vernon, N. Y.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
●White-Rodgers Electric Co., St. Louis, Mo.
Zenith Electric Co., Chicago, Ill.

SYSTEMS, COMBUSTION CONTROL

Askania Regulator Co., Chicago, Ill.
Bailey Meter Co., Cleveland, O.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Bristol Co., Waterbury, Conn.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Engineer Co., New York, N. Y.
Foster Wheeler Corp., New York, N. Y.
Hagan Corp., Pittsburgh, Pa.
●Hays Corp., Michigan City, Ind.
Hotstream Heater Co., Cleveland, O.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Mercoid Corp., Chicago, Ill.
National Brass Co., Grand Rapids, Mich.
Republic Flow Meters Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Selas Co., The, Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Wheelco Instrument Co., Chicago, Ill.
●Wing Mfg. Co., L. J., New York, N. Y.

SYSTEMS, HEATING, HOT WATER

●Barber-Colman Co., Rockford, Ill.
●Bell & Gossett Co. Morton Grove, Ill.
General Blower Co., Inc., Philadelphia, Pa.
General Fittings Co., Providence, R. I.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
Kainer & Co., Chicago, Ill.
Kehm Corp., The, Chicago, Ill.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
● Maid-O'-Mist, Inc., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Penberthy Injector Co., Detroit, Mich.
Sterling, Inc., Milwaukee, Wis.
Sullivan Valve & Engineering Co., Butte, Mont.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
Triplex Heating Specialty Co., Peru, Ind.
Watts Regulator Co., Lawrence, Mass.

SYSTEMS, HEATING, VACUUM

All-Vac Steam System, Chicago, Ill.
●Anderson Products, Inc., Cambridge, Mass.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Cashin, W. D., Boston, Mass.

● Advertisement in this issue. See Index to Advertisers, *page 326.*

●Dunham Co., C. A., Chicago, Ill.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
●Sarco Co., Inc., New York, N. Y.
Sterling, Inc., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
●Webster & Co., Warren, Camden, N. J.

SYSTEMS, HEATING, VAPOR

●American District Steam Co., North Tonawanda, N. Y.
Au-Temp-Co Corp., New York, N. Y.
Barnes & Jones, Inc., Boston, Mass.
●Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
●Sarco Co., Inc., New York, N. Y.
Sterling, Inc., Milwaukee, Wis.
Vapor Specialty Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

SYSTEMS, HEATING, ZONE CONTROL

Armstrong Heat Control Co., Portland, Ore.
Au-Temp-Co Corp., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
Barnes & Jones, Inc., Boston, Mass.
●Bell & Gossett Co., Morton Grove, Ill.
Cook Electric Co., Chicago, Ill.
●Dunham Co., C. A., Chicago, Ill.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Major Controls Sales Div., Cambridge, Mass.
Marsh Tritrol Co., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Sarco Co., Inc., New York, N. Y.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Spence Engineering Co., Inc., Walden, N. Y.
Sterling, Inc., Milwaukee, Wis.
Tallmadge & Co., Webster, East Orange, N. J.
Thrush & Co., H. A., Peru, Ind.
●Webster & Co., Warren, Camden, N. J.
Webster Tallmadge & Co., East Orange, N. J.

SYSTEMS, PROCESS HEATING, HIGH TEMPERATURE

Air Devices, Inc., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Dow Chemical Co., Midland, Mich.
Foster Wheeler Corp., New York, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Ross Engineering Corp., J. O., New York, N. Y.
Selas Co., The, Philadelphia, Pa.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Williams, Inc., F. C., Dearborn, Mich.
●Wing Mfg. Co., L. J., New York, N. Y.

SYSTEMS, ROOF SPRAYING (FOR COOLING ROOFS)

April Showers Co., Washington, D. C.
Ross Sprinkler Co., Pasadena, Cal.
Ruppright, Siegfried, New York, N. Y.
Schubert-Christy Corp., St. Louis, Mo.
●Spraying Systems Co., Chicago, Ill.
Water Cooling Corp., New York, N. Y.

SYSTEMS, SPRINKLER, FOR AIR CONDITIONING DUCT SYSTEMS

Rockwood Sprinkler Co., Worcester, Mass.

TANKS, EXPANSION, FOR HOT WATER HEATING SYSTEMS

●Bell & Gossett Co., Morton Grove, Ill.

TANKS, PROCESS AND STORAGE

Aluminum Co. of America, Pittsburgh, Pa.
American Hard Rubber Co., New York, N. Y.
American Locomotive Co., Alco Products Div., New York, N. Y.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Ames Iron Works, Div. of Pierce Butler Radiator Corp., Oswego, N. Y.
●Bell & Gossett Co., Morton Grove, Ill.
Bigelow Co., New Haven, Conn.
Biggs Boiler Wks. Co., E. Akron, O.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
Buffalo Tank Co., Arlington, Staten Island, N. Y.
Caldwell Co., W. E., Louisville, Ky.
Case & Son Mfg. Co., W. A., Buffalo, N. Y.
Chicago Bridge & Iron Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Connery Construction Co., Philadelphia, Pa.
Continental Diamond Fibre Co., Newark, Del.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Dillon Steam Boiler Wks., Inc., D. M., Fitchburg, Mass.
●Downingtown Iron Works, Downingtown, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Falstrom Co., Passaic, N. J.
Farquhar Co., Ltd., A. B., York, Pa.
Farrar & Trefts, Buffalo, N. Y.
Frank Heaters, Inc., Paterson, N. J.
●Frick Co., Waynesboro, Pa.
Gerstein & Cooper Co., South Boston, Mass.
Goodrich Co., B. F., Akron, O. (Rubber lined)
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Graver Tank & Mfg. Co., Inc., East Chicago, Ind.
Hamburg Boiler Wks., Inc., Hamburg, Pa.
Harris & Co., Arthur, Chicago, Ill.
Illinois Oil Co., Rock Island, Ill.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Framingham, Mass.
●Kewanee Boiler Corp., Kewanee, Ill.
Kirk & Blum Mfg. Co., Cincinnati, O.
Knight, Maurice A., Akron, O.
Koven & Bro., Inc., L. O., Jersey City, N. J.
La Crosse Tractor Co., La Crosse, Wis.
Lead Lined Iron Pipe Co., Wakefield, Mass.
Littleford Bros., Cincinnati, O.
Manitowoc Boiler Wks., Manitowoc, Wis.
Mauck Seamless Copper Tank Co., Victor, Norristown, Pa.
Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
Murray Iron Wks. Co., Burlington, Ia.
National Lead Co., New York, N. Y.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Quaker City Iron Wks., Philadelphia, Pa.
Richmond Engineering Co., Inc., Richmond, Va.
Roessing Mfg. Co., Pittsburgh, Pa.
Rosebraugh Co., W. W., Salem, Ore.
Scaife Co., Oakmont, Pa.
Southbridge Roofing Co., Inc., Southbridge, Mass.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Tippett & Wood, Phillipsburg, N. J.
Titusville Iron Wks. Co., Titusville, Pa.
Trageser Steam Copper Wks., John, Maspeth, Long Island, N. Y.
Uniflow Mfg. Co., Erie, Pa.
United States Rubber Co., New York, N. Y.
Vesco Corp., New York, N. Y.
Walsh-Holyoke Steam Boiler Co., Holyoke, Mass.
Waterfilm Boilers, Inc., Jersey City, N. J.
Wheeling Steel Corp., Wheeling, W. Va. (Heater)
●Whitlock Mfg. Co., Hartford, Conn.
Zallea Brothers & Johnson, Wilmington, Del.

TEMPERATURE AND HUMIDITY CONTROLS

See Humidistats; Recorder-Controllers; Thermostats

TEMPERATURE RECORDERS

See Recorders, Temperature

TEMPERATURE REGULATORS

See Regulators, Temperature

THERMOMETERS, INDICATING, INDUSTRIAL

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
American Thermometer Co., St. Louis, Mo.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Foxboro Co., Foxboro, Mass.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
●Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Martocello & Co., Jos. A., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Philadelphia Thermometer Co., Philadelphia, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
●Powers Regulator Co., Chicago, Ill.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Preferred Utilities Mfg. Corp., New York, N. Y.
Pyrometer Instrument Co., New York, N. Y.
Rochester Mfg. Co., Rochester, N. Y.
Scientific Instrument Co., Detroit, Mich.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
United States Gauge Co., New York, N. Y.
Weksler Thermometer Corp., New York, N. Y.
Weston Electrical Instrument Corp., Newark, N. J.
Wheelco Instruments Co., Chicago, Ill.

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THERMOMETERS, INDICATING, REMOTE-READING

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Engelhard, Inc., Charles, Newark, N. J.
Fee & Stemwedel, Inc., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
●Hays Corp., Michigan City, Ind.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Philadelphia Thermometer Co., Philadelphia, Pa.
●Powers Regulator Co., Chicago, Ill.
Pyrometer Instrument Co., New York, N. Y.
Rochester Mfg. Co., Rochester, N. Y.
●Sarco Co., Inc., New York, N. Y.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.
United States Gauge Co., New York, N. Y.
Wheelco Instruments Co.. Chicago, Ill.

THERMOMETERS, INDICATING, WALL

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
American Thermometer Co., St. Louis, Mo.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Fee and Stemwedel, Inc., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hill, E. Vernon, Chicago, Ill.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Martocello & Co., Jos. A., Philadelphia, Pa.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Philadelphia Thermometer Co., Philadelphia, Pa.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Pyrometer Instrument Co., New York, N. Y.
Rochester Mfg. Co., Rochester, N. Y.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.
United States Gauge Co., New York, N. Y.
Weksler Thermometer Corp., New York, N. Y. (Effective temperature indicator)
Wheelco Instruments Co., Chicago, Ill.

THERMOMETERS, KATA

G. M. Mfg. Co., New York, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Precision Thermometer & Instrument Co., Philadelphia, Pa.

THERMOSTATIC BELLOWS

See Bellows, Thermostatic

THERMOSTATIC BI-METALS

See Bi-Metals, Thermostatic

THERMOSTATIC TRAPS

See Traps, Steam, Thermostatic

THERMOSTATS, DUCT TYPE

Armstrong Heat Control Co., Portland, Ore.
Atlas Valve Co., Inc., Newark, N. J.
Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Burling Instrument Co., Newark, N. J.
Cook Electric Co., Chicago, Ill.
D & M Mfg. Co., Midland Park, N. J.
●Detroit Lubricator Co., Detroit, Mich.
Edison, Inc., Thomas A., Edison Electric Controls Div., West Orange, N. J.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
Hart Mfg. Co., Hartford, Conn.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.
Leslie Co., Lyndhurst, N. J.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Philadelphia Thermometer Co., Philadelphia, Pa.
●Powers Regulator Co., Chicago, Ill.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
●Sarco Co., New York, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Standard Thermometer, Inc., Boston, Mass.
Superstat Co., Springfield, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Tallmadge & Co., Webster, East Orange, N. J.
●Taylor Instrument Companies, Rochester, N. Y.
United Electric Controls Co., Boston, Mass.
Vapor Car Heating Co., Inc., Chicago, Ill.
Webster Tallmadge & Co., East Orange, N. J.
●White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, EFFECTIVE TEMPERATURE

●Barber-Colman Co., Rockford, Ill.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Powers Regulator Co., Chicago, Ill.

THERMOSTATS, IMMERSION

American Instrument Co., Silver Spring, Md.
Armstrong Heat Control Co., Portland, Ore.
Atlas Valve Co., Inc., Newark, N. J.
Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burling Instrument Co., Newark, N. J.
D & M Mfg Co., Midland Park, N. J.
●Detroit Lubricator Co., Detroit, Mich.
Dunn, Inc., Struthers, Philadelphia, Pa.
Edison, Inc., Thomas A., Edison Electric Controls Div., West Orange, N. J.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hart Mfg. Co., Hartford, Conn.
Industrial Engineering Corp., Terre Haute, Ind.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co. Milwaukee, Wis.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Philadelphia Thermometer Co., Philadelphia, Pa.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
● Powers Regulator Co., Chicago, Ill.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
●Sarco Co., Inc., New York, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Struthers Dunn, Inc., Philadelphia, Pa.
Superstat Co., Springfield, Mass.
Tagliabue Mfg Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
United Electric Controls Co., Boston, Mass.
Warren Electric Appliance Co., Warren, Pa.
White Mfg. Co., St. Paul, Minn.
●White-Rodgers Electric Co., St. Louis, Mo.
Wilcolator Co., Elizabeth, N. J.

THERMOSTATS, ROOM OR WALL

Armstrong Heat Control Co., Portland, Ore.
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Cook Electric Co., Chicago, Ill.
Crise Elec. Mfg. Co., Columbus, O.
●Detroit Lubricator Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●Fulton Sylphon Co., Knoxville, Tenn.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
●Illinois Engineering Co., Chicago, Ill.
Industrial Engineering Corp., Terre Haute, Ind.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.
Magnet Switch Co., Chicago, Ill.
McCorkle Co., D. H., Berkeley, Calif.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.

● Advertisement in this issue. See Index to Advertisers, page 326.

Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
●Powers Regulator Co., Chicago, Ill.
Russell Electric Co., Chicago, Ill.
Sampsel Time Control, Inc., Spring Valley, Ill.
●Sarco Co., Inc., New York, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Standard Thermometer, Inc., Boston, Mass.
Superstat Co., Springfield, Mass.
Tallmadge & Co., Webster, East Orange, N. J.
Thrush & Co., H. A., Peru, Ind.
Triplex Heating Specialty Co., Peru, Ind.
United Electric Controls Co., Boston, Mass.
Vapor Car Heating Co., Inc., Chicago, Ill.
Webster Tallmadge & Co., East Orange, N. J.
White Mfg. Co., St. Paul, Minn.
●White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, SURFACE

Armstrong Heat Control Co., Portland, Ore.
Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Cook Electric Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Dunn, Inc., Struthers, Philadelphia, Pa.
Edison, Inc., Thomas A., Edison Electric Controls Div., West Orange, N. J.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
Hart Mfg. Co., Hartford, Conn.
Industrial Engineering Corp., Terre Haute, Ind.
Jefferson Electric Co., Bellwood, Ill.
McCorkle Co., D. H., Berkeley, Cal.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The Dayton, Ohio.
●Powers Regulator Co., Chicago, Ill.
Ranco, Inc., Columbus, O.
●Sarco Co., Inc., New York, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Struthers Dunn, Inc., Philadelphia, Pa.
Superstat Co., Springfield, Mass.
United Electric Controls Co., Boston, Mass.
White Mfg. Co., St. Paul, Minn.
●White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, TWO TEMPERATURE OR DUAL

Armstrong Heat Control Co., Portland, Ore.
Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Burling Instrument Co., Newark, N. J.
●Detroit Lubricator Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●General Controls Co., Glendale, Cal.
●General Electric Co., Air Conditioning & Commercial Refrigeration Dept., Bloomfield, N. J.
Gleason-Avery, Inc., Auburn, N. Y.
H-B Instrument Co., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Industrial Engineering Corp., Terre Haute, Ind.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
●Powers Regulator Co., Chicago, Ill.
Ranco, Inc., Columbus, O.
●Sarco Co., Inc., New York, N. Y.
Superstat Co., Springfield, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Tallmadge & Co., Webster, East Orange, N. J.
United Electric Controls Co., Boston, Mass.
Vapor Car Heating Co., Inc., Chicago, Ill.
Webster Tallmadge & Co., East Orange, N. J.
●White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, WEATHER COMPENSATING

Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Detroit Lubricator Co., Detroit, Mich.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Major Controls Sales Div., Cambridge, Mass.
Marsh Tritrol Co., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Powers Regulator Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.

Tallmadge & Co., Webster, East Orange, N. J.
Thrush & Co., H. A., Peru, Ind.
United Electric Controls Co., Boston, Mass.
Webster Tallmadge & Co., East Orange, N. J.

TIME SWITCHES

See Switches, Time

TOGGLE BOLTS

See Bolts, Toggle and Anchor

TONGS, PIPE

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Jarecki Mfg. Co., Erie, Pa.
Trimont Mfg. Co., Boston, Mass.
●Williams & Co., J. H., New York, N. Y.

TOOLS (CHISELS, PLIERS, SCREW DRIVERS, ETC.)

Bernz Co., Inc., Otto, Rochester, N. Y.
Billings & Spencer Co., Hartford, Conn.
Bonney Forge & Tool Works, Allentown, Pa.
Crescent Tool Co., Jamestown, N. Y.
International Nutyp Tool Co., Oswego, N. Y.
Parker-Kalon Corp., New York, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Snap-On Tools Corp., Kenosha, Wis.
Stanley Electric Tool Div., The Stanley Works, New Britain, Conn.

TORCHES, BRAZING

Aeroil Burner Co., Inc., West New York, N. J.
●Air Reduction Sales Co., New York, N. Y.
Bernz Co., Inc., Otto, Rochester, N. Y.
Burdett Mfg. Co., Chicago, Ill.
Clayton & Lambert Mfg. Co., Detroit, Mich.
Dockson Corp., Detroit, Mich.
Gasweld Equipment Co., Chicago, Ill.
Harris Calorific Co., The, Cleveland, O.
Imperial Brass Mfg. Co., Chicago, Ill.
Insto-Gas Corp., Detroit, Mich.
Johnson Gas Appliance Co., Cedar Rapids, Ia.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Marquette Mfg. Co., Minneapolis, Minn.
Milburn Co., Alexander, Baltimore, Md.
Minn-Kota Foundry & Mfg. Co., Fargo, N. D.
Modern Engineering Co., St. Louis, Mo.
National Cylinder Gas Co., Chicago, Ill.
National Safety Device Co., Chicago, Ill.
Reiner & Campbell, Inc., Elizabeth, N. J.
Sight Feed Generator Co., Richmond, Ind.
Smith Welding Equipment Corp., Minneapolis, Minn.
Torchweld Equipment Div., National Cylinder Gas Co., Chicago, Ill.
Trindl Products, Ltd., Chicago, Ill.
Welding Apparatus Co., Chicago, Ill.

TORQUE INDICATING WRENCHES

See Wrenches, Torque Indicating

TOWERS, COOLING, ATMOSPHERIC

American Cooling Tower Co., Kansas City, Mo.
●Binks Mfg. Co., Chicago, Ill.
Burhorn Co., Edwin, New York, N. Y.
Fluor Corp., Ltd., The, Los Angeles, Cal.
Foster Wheeler Corp., New York, N. Y.
Harry Cooling Towers, Inc., New York, N. Y.
Lilie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.
●Marley Co., Kansas City, Kans.
●New England Cooling Tower Co., Boston, Mass.
Pennsylvania Engineering Wks., New Castle, Pa.
Phillips Cooling Tower Co., Inc., New York, N. Y.
Pritchard & Co., J. F., Kansas City, Mo.
Research Corp., New York, N. Y.
Schubert-Christy Corp., Affton, St. Louis, Mo.
Stewart Ice Machine Co., Los Angeles, Cal.
Tippett & Wood, Phillipsburg, N. J.
Water Cooling Corp., New York, N. Y.
Water Cooling Tower Co., Chicago, Ill.

TOWERS, COOLING, MECHANICAL DRAFT

American Cooling Tower Co., Kansas City, Mo.
●Binks Mfg. Co., Chicago, Ill.
Burhorn Co., Edwin, New York, N. Y.
Fluor Corp., Ltd., The, Los Angeles, Cal.
Foster Wheeler Corp., New York, N. Y.
Harry Cooling Towers, Inc., New York, N. Y.
Lilie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.
●Marley Co., Kansas City, Kans.
●New England Cooling Tower Co., Boston, Mass.
Pennsylvania Engineering Wks., New Castle, Pa.
Phillips Cooling Tower Co., Inc., New York, N. Y.
Pritchard & Co., J. F., Kansas City, Mo.
Research Corp., New York, N. Y.
Schubert-Christy Corp., Affton, St. Louis, Mo.
Water Cooling Corp., New York, N. Y.
Water Cooling Tower Co., Chicago, Ill.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.

● Advertisement in this issue. See Index to Advertisers, page 326.

TRANSMISSION DRIVES
See Drives, Chain, Flat Belt and V-Belt

TRAPS, STEAM, MECHANICAL
●American District Steam Co., North Tonawanda, N. Y.
●Anderson Co., V. D., The, Cleveland, O.
●Armstrong Machine Wks., Three Rivers, Mich.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
●Bishop & Babcock Mfg. Co., Cleveland, O.
Boylston Steam Specialty Co., Chicago, Ill.
Bundy Steam Trap Co., Nashua, N. H.
Burrows Mfg. Co., F. A., York, Pa.
Cash Universal Regulator Co., Marshalltown, Ia.
Cashin Co., W. D., Boston, Mass.
●Cochrane Corp., Philadelphia, Pa.
Coe Mfg. Co., Painesville, O.
Crane Co., Chicago, Ill.
Cryer Trap & Valve Co., Inc., New York, N. Y.
Davis Regulator Co., Chicago, Ill.
●Dunham Co., C. A., Chicago, Ill.
Ellis Drier Co., Chicago, Ill.
●Fisher Governor Co., Marshalltown, Ia.
●Haines & Co., William S., Philadelphia, Pa.
Healy Ruff Co., St. Paul, Minn.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
Justus Steam Trap Co., Napanoch, N. Y.
Kaye & MacDonald, Inc., West Orange, N. J.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
McAuley Trap Co., Pittsburgh, Pa.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Morehead Mfg. Co., Detroit, Mich.
Mouat Vapor Heating Co., The, Cleveland, O.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Nason Co., Detroit, Mich.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
●Sarco Co., Inc., New York, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Squires Co., C. E., Cleveland, O.
Sterling, Inc., Milwaukee, Wis.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Templeton Bros., Boston, Mass. (Return)
Templeton Mfg. Co., Hyde Park, Mass.
●Trane Co., LaCrosse, Wis.
Trerice Co., H. O., Detroit, Mich.
Vapor Specialty Co., New York, N. Y.
Watson & McDaniel Co., Philadelphia, Pa.
●Webster & Co., Warren, Camden, N. J.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.
●Yarnall-Waring Co., Philadelphia, Pa.

TRAPS, STEAM, THERMOSTATIC
●American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
●Bishop & Babcock Mfg. Co., Cleveland, O.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Cashin Co., W. D., Boston, Mass.
●Clifford Mfg. Co., Boston, Mass.
Cryer Trap & Valve Co., Inc., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
●Haines & Co., William S., Philadelphia, Pa.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
●Powers Regulator Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling, Inc., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Trane Co., La Crosse, Wis.
Trerice Co., H. O., Detroit, Mich.
Vapor Car Heating Co., Inc., Chicago, Ill.
Vapor Specialty Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

TUBE CLEANERS
See Cleaners, Tube

TUBES, BOILER
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Globe Steel Tubes Co., Milwaukee, Wis.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keeney Mfg. Co., Newington, Conn.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Oil City Tank and Boiler Co., Oil City, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Steel & Tubes, Div. of Republic Steel Corp., Cleveland, O.
Timken Steel & Tube Co., Canton, O.
●Youngstown Sheet & Tube Co., Youngstown, O.

TUBES, PITOT
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
Hill, E. Vernon, Chicago, Ill.
Meriam Co., The, Cleveland, O.

TUBING, ALUMINUM
Aluminum Co. of America, Pittsburgh, Pa.
Brasco Mfg. Co., Harvey, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Wolverine Tube Co., Detroit, Mich.

TUBING BENDERS
See Benders, Tubing

TUBING, BRASS AND COPPER
●American Brass Co., Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Conklin Brass & Copper Co., Inc., T. E., New York, N. Y.
Downs-Smith Brass & Copper Co., New York, N. Y.
Foster Wheeler Corp., New York, N. Y.
●Hussey & Co., C. G., Pittsburgh, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
●Lewin-Mathes Co., Lewin Metals Div., East St. Louis, Ill.
●McDonnell & Miller, Chicago, Ill.
●Mueller Brass Co., Port Huron, Mich.
Parker Appliance Co., Cleveland, O.
Phelps Dodge Copper Products Corp., British American Tube Div., New York, N. Y.
Revere Copper and Brass, Incorporated, New York, N. Y.
Roberts Tube Works, Detroit, Mich.
Scovill Mfg. Co., Waterville Div., Waterville, Conn.
Wolverine Tube Co., Detroit, Mich.

TUBING CUTTERS
See Cutters, Tubing

TUBING, FINNED
●Aerofin Corp., Syracuse, N. Y.
Brown Fintube Co., The, Elyria, O.
●Bush Mfg. Co., Hartford, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●G. & O. Mfg. Co., New Haven, Conn.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kramer Trenton Co., Trenton, N. J.
Manufacturers Fin Coil Co., Chicago, Ill.
●McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
●Tilco-Fin, Inc., Brooklyn, N. Y.
Vapor Car Heating Co., Inc., Chicago, Ill.
Wolverine Tube Co., Detroit, Mich. (Aluminum, copper)

TUBING, NICKEL AND NICKEL ALLOY
General Plate Div., Metals & Controls Corp., Attleboro, Mass.
Globe Steel Tubes Co., Milwaukee, Wis.
International Nickel Co., New York, N. Y.
Revere Copper and Brass, Incorporated, New York, N. Y.

TUBING, PLASTIC
Dow Chemical Co., Midland, Mich.

TUBING, SILVER CLAD AND SILVER ALLOY
General Plate Div., Metals & Controls Corp., Attleboro, Mass.

TUBING, STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Co., New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Brasco Mfg. Co., Harvey, Ill.
Bundy Tubing Co., Detroit, Mich.
Detroit Seamless Steel Tubes Co., Detroit, Mich.
Globe Steel Tubes Co., Milwaukee, Wis.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.

● Advertisement in this issue. See Index to Advertisers, page 326.

Oil City Tank and Boiler Co., Oil City, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Revere Copper and Brass, Incorporated, New York, N. Y.
South Chester Tube Co., Chester, Pa.
●Spang Chalfant, Inc., Div. of National Supply Co., Pittsburgh, Pa.
Standard Tube Co., Highland Park, Mich.
Steel and Tubes, Div. of Republic Steel Corp., Cleveland, O.
Timken Steel & Tube Co., Canton, O.
Wheatland Tube Co., Philadelphia, Pa.
Wheeling Steel Corp., Wheeling, W. Va.
●Youngstown Sheet & Tube Co., Youngstown, O.

TUBING, STEEL, STAINLESS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Alloy Steel Products Co., Linden, N. J.
Babcock & Wilcox Co., New York, N. Y.
Brasco Mfg. Co., Harvey, Ill.
Carpenter Steel Co., Reading, Pa.
Colonial Alloys Co., Metals Div., Philadelphia, Pa.
Duraloy Co., Scottdale, Pa.
Globe Steel Tubes Co., Milwaukee, Wis.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Steel and Tubes, Div. of Republic Steel Corp., Cleveland, O.
Timken Steel & Tube Co., Canton, O.

TURBINES, MECHANICAL DRIVE

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Carling Blower Co., Worcester, Mass.
Coppus Engineering Corp., Worcester, Mass.
Dean Hill Pump Co., Anderson, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Elliott Co., Jeannette, Pa.
●General Electric Co., Schenectady, N. Y.
Moore Steam Turbine Div., Worthington Pump & Machinery Corp., Wellsville, N. Y.
Murray Iron Wks. Co., Burlington, Ia.
Sterling Pump Corp., Hamilton, O.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Terry Steam Turbine Co., Hartford, Conn.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Wing Mfg. Co., L. J., New York, N. Y.

2, 3 AND 4-WAY VALVES

See Valves, 2, 3 and 4-way

UNDERGROUND PIPING

See Conduit, Underground Piping

UNIONS, BRASS

Belknap Mfg. Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.
Crane Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
General Fittings Co., Providence, R. I.
Grabler Mfg. Co., Cleveland, O.
Hays Mfg. Co., Erie, Pa.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., The, Elmira, N. Y.
King Union Co., Inc., Hillsgrove, R. I.
Lunkenheimer Co., Cincinnati, O.
● Mueller Brass Co., Port Huron, Mich.
Ohio Brass Co., Mansfield, O. (Elbows)
Parker Appliance Co., Cleveland, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Powell Co., Wm., Cincinnati, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburg, Pa.
Williams Valve Co., D. T., Cincinnati, O.

UNIONS, MALLEABLE, BRASS SEAT

Corley Co., Jersey City, N. J.
Crane Co., Chicago, Ill.
●Dart Mfg. Co., E. M., Providence R. I.
Detroit Brass & Malleable Wks., Detroit, Mich.
Devlin Mfg. Co., Inc., Thos, Burlington, N. J.
●Fairbanks Co., New York, N. Y.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
General Fittings Co., Providence R. I.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jefferson Union Co., Lexington, Mass.
Jefferson Union Co., Inc., Lockport, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
King Union Co., Inc., Hillsgrove, R. I.
●Malleable Iron Fittings Co., Branford, Conn.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Rockwood Sprinkler Co., Worcester, Mass.
Standard Union Co., Lockport, N. Y.
Star Mfg. Co., Inc., Providence, R. I.
Stockham Pipe Fittings Co., Birmingham, Ala.
United Superior Union Co., Inc., Brooklyn, N. Y.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburg, Pa.

UNIONS, STEEL

Alloy Steel Products Co., Linden, N. J.
Central Forging Co., Catawissa, Pa.
Champion Machine & Forging Co., Cleveland, O.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
Crane Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
Rockwood Sprinkler Co., Worcester, Mass.
Roessing Mfg. Co., Pittsburgh, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.

UNIT COOLERS

See Coolers, Unit

UNIT HEATERS

See Heaters, Unit

UNIT VENTILATORS

See Ventilators, Unit

UNITS, AIR CONDITIONING, CENTRAL STATION TYPE

Self contained blower, heating and/or cooling coil, filter, humidifier unit for remote location and duct air distribution

●Air & Refrigeration Corp., New York, N. Y.
Airtemp, Div. of Chrysler Corp., Dayton, O.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Blower Corp., Detroit, Mich.
American Cooling Tower Co., Kansas City, Mo.
Anetsberger Bros., Chicago, Ill.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Beacon-Morris Corp., Boston, Mass. (Custom built)
Betz Air Conditioning Corp., Kansas City, Mo.
●Bryant Heater Co., The, Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Coroaire Heater Corp., The, Cleveland, O.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Fairbanks, Morse & Co., Chicago, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Forman Air Conditioning & Engrg. Co., New York, N. Y.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Governair Corp., Oklahoma City, Okla.
Hastings Air Conditioning Co., Hastings, Neb.
Howe Ice Machine Co., Chicago, Ill.
●Ilg Electric-Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
●Marlo Coil Co., St. Louis, Mo.
McLouth Air Conditioning Corp., Lansing, Mich.
●McQuay, Inc., Minneapolis, Minn.
Micheli Air Conditioning Co., Inc., Schenectady, N. Y.
Modine Mfg. Co., Racine, Wis.
●Nesbitt, Inc., John J., Philadelphia, Pa.
Niagara Blower Co., New York, N. Y.
Palmer's Mfg. Corp., Phoenix, Ariz.
Pernot & Rich, Inc., Los Angeles, Cal.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Scott-Newcomb, Inc., St. Louis, Mo.
Simmons Co., Gordon H., Milwaukee, Wis.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Standard Computing Scale Co., The, Air Conditioning and Refrigeration Div., Detroit, Mich.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●Surface Combustion Corp., Toledo, O.
●Trane Co., La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
United States Radiator Corp., Detroit, Mich.
●Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, HORIZONTAL PACKAGE TYPE

Self contained blower, cooling and/or heating coil, filter, humidifier unit for ceiling or platform location in space condition, for connection to remote compressor or cold water supply, and steam or hot water

Airtemp, Div. of Chrysler Corp., Dayton, O.
American Blower Corp., Detroit, Mich.

● Advertisement in this issue. See Index to Advertisers, page 326.

●Baker Ice Machine Co., Inc., Omaha, Neb.
Beacon-Morris Corp., Boston, Mass. (Custom built)
●Buffalo Forge Co., Buffalo, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y.
Champion Unit Heater Co., Chicago, Ill.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
Coroaire Heater Corp., The, Cleveland, O.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Fairbanks, Morse & Co., Chicago, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Hastings Air Conditioning Co., Hastings, Neb.
●Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
King Ventilating Co., Owatonna, Minn.
Kramer Trenton Co., Trenton, N. J.
●Marlo Coil Co., St. Louis, Mo.
Mayflower Air-Conditioners, Inc., St. Paul, Minn.
McLouth Air Conditioning Corp., Lansing, Mich.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Niagara Blower Co., New York, N. Y.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Standard Computing Scale Co., The, Air Conditioning and Refrigeration Div., Detroit, Mich.
●Sturtevant Co., B. F., Boston, Mass.
●Trane Co., La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
United States Radiator Corp., Detroit, Mich.
●Vilter Mfg. Co., Milwaukee, Wis.
●Webster & Co., Warren, Camden, N. J.
Western Blower Co., Seattle, Wash.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, INDUSTRIAL TYPE

●Air & Refrigeration Corp., New York, N. Y.
American Blower Corp., Detroit, Mich.
American Cooling Tower Co., Kansas City, Mo.
Anetsberger Bros., Chicago, Ill.
Bahnson Co., Winston-Salem, N. C.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Beacon-Morris Corp., Boston, Mass. (Custom built)
Betz Air Conditioning Corp., Kansas City, Mo.
Brundage Co., The, Kalamazoo, Mich.
●Bryant Heater Co., The, Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Economy Equipment Co., Inc., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●Frick Co., Waynesboro, Pa.
●General Electric Co., Air Conditioning & Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Howe Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
International Moistening Co., Providence, R. I.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
●Marlo Coil Co., St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.
Niagara Blower Co., New York, N. Y.
Norwood Filtration Co., The, Florence, Mass.
Parks-Cramer Co., Fitchburg, Mass.
Pfening Co., Fred D., Columbus, O.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Research Corp., New York, N. Y.
Ross Engineering Corp., J. O., New York, N. Y.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
● Somers, Inc., H. J., Detroit, Mich.
● Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●Surface Combustion Corp., Toledo, O.
●Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, SUMMER, EVAPORATIVE COOLING TYPE

For cooling with sprays, no dehumidification

●Air & Refrigeration Corp., New York, N. Y.
Air Equipment Co., Denver, Colo.
Air-O-Line Co., The, Dallas, Tex.
Alter Co., Harry, Chicago, Ill.
American Blower Corp., Detroit, Mich.
American Cooling Tower Co., Kansas City, Mo.
American Metal Products Co., Fort Worth, Tex.
Aqua-Mist Co., Topeka, Kans.
Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Ballantyne Co., Omaha, Nebr.
Bien Air Conditioning Co., Bell, Cal.
Campbell Heating Co., E. K., Kansas City, Mo.
Coolmaster Corp., Chicago, Ill.
Dallas Engineering Co., Inc., Dallas, Tex.
Economy Electric Mfg. Co., Chicago, Ill.
Electrogas Furnace Co., San Francisco, Cal.
Essick Mfg. Co., Los Angeles, Cal.
Fairbanks, Morse & Co., Chicago, Ill.
Great National Air Conditioning Corp., Dallas, Tex.
Hall Mfg. Co., Cedar Rapids, Ia.
Hammond Aircraft Corp., South San Francisco, Cal.
Little Giant Vaporizer Co., Oklahoma City, Okla.
Montag Stove & Furnace Works, Portland, Ore.
Mountain States Equipment Co., Denver, Col.
Norman Sheet Metal Mfg. Co., W. F., Nevada, Mo.
Northwest Stove Works, Portland, Ore.
Pacific Gas Radiator Co., Huntington Park, Cal.
Palmer's Mfg. Corp., Phoenix, Ariz.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Pernot & Rich, Inc., Los Angeles, Cal.
Royal Air Conditioning Equipment Co., Alhambra, Cal.
Shreveport Engineering Co., Inc., Shreveport, La.
Spray-Wheel Air Conditioners, Inc., Denver, Colo.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Western Blower Co., Seattle, Wash.
X L Refrigerating Co., Chicago, Ill.

UNITS, AIR CONDITIONING, SUMMER, ROOM TYPE, FLOOR CABINET, REMOTE COMPRESSOR OR COLD WATER, UNDER 3 TONS CAPACITY

Self contained blower, coil, filter unit for connection to remote compressor or cold water supply

Airgard Mfg. Co., Chicago, Ill.
Airtemp, Div. of Chrysler Corp., Dayton, O.
Carrier Corp., Syracuse, N. Y.
●Dunham Co., C. A., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
General Air Conditioning Corp., Cincinnati, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
Giant Mfg. Co., Council Bluffs, Ia.
Hall Mfg. Co., Cedar Rapids, Ia.
Hastings Air Conditioning Co., Hastings, Neb.
●Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
King Ventilating Co., Owatonna, Minn.
McLouth Air Conditioning Corp., Lansing, Mich.
●McQuay, Inc., Minneapolis, Minn.
●Nesbitt, Inc., John J., Philadelphia, Pa.
Norwin Co., Freeport, Ill.
Peerless of America, Inc., Chicago, Ill.
Perham Products, Inc., Chicago, Ill.
Premier Furnace Co., Dowagiac, Mich.
Refrigeration Economics Co., Inc., Canton, O.
Scott-Newcomb, Inc., St. Louis, Mo.
Standard Computing Scale Co., The, Air Conditioning and Refrigeration Div., Detroit, Mich.
●Trane Co., La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Unified Air Conditioner Co., Duluth, Minn.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
X L Refrigerating Co., Chicago, Ill.
● York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, SUMMER, ROOM TYPE, FLOOR CABINET, SELF CONTAINED COMPRESSOR, UNDER 3 HP

Self contained blower, coil, compressor, filter unit

Airmode Mfg. Co., Chicago, Ill.
Airtemp, Div. of Chrysler Corp., Dayton, O.

● Advertisement in this issue. See Index to Advertisers, page 326.

●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y.
Certified Products Co., Toledo, O. (Window sill mounted)
Coroaire Heater Corp., The, Cleveland, O.
Fairbanks, Morse & Co., Chicago, Ill.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
Gale Products, Galesburg, Ill.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Governair Corp., Oklahoma City, Okla.
Harvey-Whipple, Inc., Springfield, Mass.
Ice Cooling Appliance Corp., Morrison, Ill. (Ice)
●Ilg Electric Ventilating Co., Chicago, Ill.
Indian Trailer Corp., Koolroom Div., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Meyer Furnace Co., Peoria, Ill.
Peerless of America, Inc., Chicago, Ill.
Philco Corp., Philadelphia, Pa.
Pleasantaire Corp., Washington, D. C.
Premier Furnace Co., Dowagiac, Mich.
Refrigeration Economics Co., Inc., Canton, O.
Scott-Newcomb, Inc., St. Louis, Mo.
●Trane Co., La Crosse, Wis.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
●York Ice Machinery Corp., York, Pa.

UNITS, AIR CONDITIONING, SUMMER, STORE TYPE, FLOOR CABINET, SELF CONTAINED COMPRESSOR, 3 HP AND OVER

Self contained blower, coil, compressor, filter unit with air discharge approximately 6 ft. above floor

Airtemp, Div., of Chrysler Corp., Dayton, O.
●Baker Ice Machine Co., Inc., Omaha, Neb.
●Buffalo Forge Co., Buffalo, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.
Forman Air Conditioning & Engrg. Co., New York, N. Y.
●Frick Co., Waynesboro, Pa.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Nevinger Mfg. Co., Greenville, Ill.
Niagara Blower Co., New York, N. Y.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Scott-Newcomb, Inc., St. Louis, Mo.
●Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

UNITS, AIR CONDITIONING, WINTER, ROOM TYPE, FLOOR CABINET

Self contained blower, filter, heating coil, humidifier unit

●Air & Refrigeration Corp., New York, N. Y.
●Burnham Boiler Corp., Irvington, N. Y.
Campbell Heating Co., Des Moines, Ia.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Dunham Co., C. A., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
●Ilg Electric Ventilating Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.
●Nesbitt, Inc., John J., Philadelphia, Pa.
Pan-American Engineering Co., Berkeley, Cal.
Peerless of America, Inc., Chicago, Ill.
Perham Products, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
●Reznor Mfg. Co., Mercer, Pa.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
●Somers, Inc., H. J., Detroit, Mich.
Standard Computing Scale Co., The, Air Conditioning and Refrigeration Div., Detroit, Mich.
●Surface Combustion Corp., Toledo, O.
●Trane Co., La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Unified Air Conditioner Co., Duluth, Minn.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, YEAR AROUND, ROOM TYPE, FLOOR CABINET

Self contained blower, cooling and heating coil, filter, humidifier unit for connection to remote compressor or cold water supply, and steam or hot water supply

●Air & Refrigeration Corp., New York, N. Y.
Airtemp, Div. of Chrysler Corp., Dayton, O.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Beacon-Morris Corp., Boston Mass. (Custom built)
Betz Air Conditioning Corp., Kansas City, Mo.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Coroaire Heater Corp., The, Cleveland, O.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
●Dunham Co., C. A., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
●Grinnell Co., Inc., Providence, R. I.
Hastings Air Conditioning Co., Hastings, Neb.
●Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Kennard, Inc., Sam, St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
●McQuay, Inc., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, Moline, Ill.
●Nesbitt, Inc., John J., Philadelphia, Pa.
Peerless of America, Inc., Chicago, Ill.
Perham Products, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Semco Mfg. Co., Nashville, Tenn.
Standard Computing Scale Co., The, Air Conditioning and Refrigeration Div., Detroit, Mich.
Tenney Engineering, Inc., Bloomfield, N. J.
●Trane Co., La Crosse, Wis.
Unified Air Conditioner Co., Duluth, Minn.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
●York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, WINDOW VENTILATOR AND FILTER

Ad-Lee Co., Inc., Chicago, Ill.
Airgard Mfg. Co., Chicago, Ill.
Airmode Mfg. Co., Chicago, Ill.
American Air Conditioning Co., Detroit, Mich.
Automatic Ventilator Co., Corunna, Mich.
Berger Mfg. Div., Republic Steel Corp., Canton, O.
Carrier Corp., Syracuse, N. Y.
Davies Air Filter Corp., New York, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
Gale Products, Galesburg, Ill.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
●Ilg Electric Ventilating Co., Chicago, Ill.
Kaiser Co., H. S., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Mellish & Murray Co., Chicago, Ill.
Reed Unit-Fans, Inc., New Orleans, La.
●Somers, Inc., H. J., Detroit, Mich.
●Staynew Filter Corp., Rochester, N. Y.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Unified Air Conditioner Co., Duluth, Minn.
Utility Fan Corp., Los Angeles, Cal.
Vita-Screen Ventilator Co., New York, N. Y.

UNIVERSAL JOINTS

See Joints, Universal, for Operating Valves

VACUUM GAGES

See Gages, Indicating, Vacuum

VACUUM HEATING SYSTEMS

See Systems, Heating, Vacuum

VACUUM PUMPS

See Pumps, Vacuum

VACUUM RECORDERS

See Recorders, Pressure and Vacuum

VALVE OPERATORS

See Operators, Valve

VALVE RESEATERS

See Reseaters, Valve

VALVES, ANGLE

Albright Equipment Co., Pittsburgh, Pa.
Alloy Steel Products Co., Linden, N. J.
●American Brass Co., Waterbury, Conn.

● Advertisement in this issue. See Index to Advertisers, page 326.

Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Bordo Co., Inc., L. J., Glenside, Pa. (Plug)
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Central Brass Mfg. Co., Cleveland, O.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Gorton Heating Corp., Cranford, N. J.
●Grinnell Co., Inc., Providence, R. I.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Milwaukee Valve Co., Milwaukee, Wis.
●Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Parker Appliance Co., Cleveland, O.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rockford Brass Works, Rockford, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Stockham Pipe Fittings Co., Birmingham, Ala.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
White Flo-Matic Corp., Hoosick Falls, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, BALANCING, RADIATOR, FOR FORCED HOT WATER HEATING SYSTEMS

●Bell & Gossett Co., Morton Grove, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Hammond Brass Works, Hammond, Ind.
Marsh Valve Co., Dunkirk, N. Y.

VALVES, BLOW-OFF

Alloy Steel Products Co., Linden, N. J.
Babcock & Wilcox Co., New York, N. Y.
Barrett Machine Co., N. S. Pittsburgh, Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Clees Valve & Engineering Co., New York, N. Y.
●Cochrane Corp., Philadelphia, Pa.
Crane Co., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Elliott Co., Jeannette, Pa.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Keckley Co., O. C., Chicago. Ill.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
●McDonnell & Miller, Chicago, Ill.
Merco Nordstrom Valve Co., Pittsburgh, Pa.
Norgren Co., Inc., C. A., Denver, Colo.
Ohio Injector Co., Wadsworth, O.
Parker Appliance Co., Cleveland, O.
Permutit Co., New York, N. Y.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
●Yarnall-Waring Co., Philadelphia, Pa.

VALVES, CHECK

Albright Equipment Co., Pittsburgh, Pa.
Alloy Steel Products Co., Linden, N. J.
American Hard Rubber Co., New York, N. Y. (Hard rubber)
Barrett, Haentjens & Co., Hazleton, Pa.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Central Forging Co., Catawissa, Pa.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Cochrane Corp., Philadelphia, Pa.
Cooper Co., Clark, Philadelphia, Pa.
Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
Eclipse Fuel Engineering Co., Rockford, Ill.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Fairbanks Co., New York, N. Y.
Foster Engineering Co., Newark, N. J.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
●Grinnell Co., Inc., Providence, R. I.
Hammond Brass Works, Hammond, Ind.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
Illinois Malleable Iron Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Locke Regulator Co., Salem, Mass.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Milwaukee Valve Co., Milwaukee, Wis.
Mueller Co., Decatur, Ill.
●Mueller Brass Co., Port Huron, Mich.
Norgren Co., Inc., C. A., Denver, Colo.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Parker Appliance Co., Cleveland, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
Preferred Utilities Mfg. Corp., New York, N. Y.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rensselaer Valve Co., Cohoes, N. Y.
Rockford Brass Works, Rockford, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass. (Bleeder type)
Schutte & Koerting Co., Philadelphia, Pa.
Smolensky Valve Co., Inc., Cleveland, O.
Sterling, Inc., Milwaukee, Wis.
Stockham Pipe Fittings Co., Birmingham, Ala.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Taco Heaters, Inc., New York, N. Y.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J. (Hydraulic service)
White Flo-Matic Corp., Hoosick Falls, N. Y.
Williams Gauge Co., Pittsburgh, Pa. (Noiseless)
Williams Valve Co., D. T., Cincinnati, O.

VALVES, DIAPHRAGM

American Hard Rubber Co., New York, N. Y. (Rubber lined)
American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Atlas Valve Co., Inc., Newark, N. J.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Bristol Co., Waterbury, Conn.
●Cash Co., A. W., Decatur, Ill.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Cooper Co., Clark, Philadelphia, Pa.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Eclipse Fuel Engineering Co., Rockford, Ill.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●General Controls Co., Glendale, Cal.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Henry Valve Co., Chicago, Ill.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Kieley & Mueller Co., Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Kunkle Valve Co., Ft. Wayne, Ind.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Mueller Brass Co., Port Huron, Mich.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Northern Indiana Brass Co., Elkhart, Ind.
Parks-Cramer Co., Fitchburg, Mass.
Powell Co., Wm., Cincinnati, O.
●Powers Regulator Co., Chicago, Ill.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.

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Spence Engineering Co., Inc., Walden, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
●Trane Co., La Crosse, Wis.
Trerice Co., H. O., Detroit, Mich.
Triplex Heating Specialty Co., Peru, Ind.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●White-Rodgers Electric Co., St. Louis, Mo.

VALVES, FLOAT

Albright Equipment Co., Pittsburgh, Pa.
American Hard Rubber Co., New York, N. Y. (Hard rubber)
Atlas Valve Co., Inc., Newark, N. J.
●Automatic Products Co., Milwaukee, Wis. (Oil)
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Caldwell Co., W. E., Louisville, Ky.
●Cash Co., A. W., Decatur, Ill.
Central Brass Mfg. Co., Cleveland, O.
Chase Brass & Copper Co., Waterbury, Conn.
Cooper Co., Clark, Philadelphia, Pa.
Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Eclipse Fuel Engineering Co., Rockford, Ill.
Eddy Valve Co., Waterford, N. Y.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Hanlon-Waters, Inc., Tulsa, Okla.
Hasco Valve & Machine Co., Milwaukee, Wis.
●Illinois Engineering Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kieley & Mueller Co., Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Locke Regulator Co., Salem, Mass.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
●Maid-O'-Mist, Inc., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Monash-Younker Co., Chicago, Ill.
Monmouth Products Co., Cleveland, O.
●Mueller Brass Co., Port Huron, Mich.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Phillips & Co., H. A., Chicago, Ill.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rockford Brass Works, Rockford, Ill.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schaub Engineering Co., Fred H., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Stickle Steam Specialties Co., Indianapolis, Ind.
Swartwout Co., Cleveland, O.
●Trane Co., La Crosse, Wis.
Viking Air Conditioning Corp., Cleveland, O.
Voss Co., J. H. H., New York, N. Y.
Watts Regulator Co., Lawrence, Mass.

VALVES, FLOW CONTROL, FOR HOT WATER HEATING SYSTEMS

●Bell & Gossett Co., Morton Grove, Ill.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
●Trane Co., La Crosse, Wis.

VALVES, FORGED STEEL

Albright Equipment Co., Pittsburgh, Pa.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Clees Valve & Engineering Co., New York, N. Y.
Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Everlasting Valve Co., Jersey City, N. J.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Henry Valve Co., Chicago, Ill.
Merco-Nordstrom Valve Co., Pittsburgh, Pa.
Parker Appliance Co., Cleveland, O.
Schutte & Koerting Co., Philadelphia, Pa.
Steel Improvement & Forge Co., Cleveland, O.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.

VALVES, GATE, BRASS AND BRONZE

●American Brass Co., Waterbury, Conn.
American Injector Co., Detroit, Mich.
Belknap Mfg. Co., Bridgeport, Conn.
Bordo Co., Inc., L. J., Glenside, Pa.
Capitol Brass Works, Div. of Bohn Aluminum Brass Corp., Detroit, Mich.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Chase Brass & Copper Co., Waterbury, Conn.
Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
Eddy Valve Co., Waterford, N. Y.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Hammond Brass Wks., Hammond, Ind.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Milwaukee Valve Co., Milwaukee, Wis.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
R-S Products Corp., Philadelphia, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rensselaer Valve Co., Cohoes, N. Y.
Rockford Brass Works, Rockford, Ill.
Scott Valve Mfg. Co., Detroit, Mich.
Stockham Pipe Fittings Co., Birmingham, Ala.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GATE, IRON BODY

Bordo Co., Inc., L. J., Glenside, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Eddy Valve Co., Waterford, N. Y.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
●McDonnell & Miller, Chicago, Ill.
Ohio Injector Co., Wadsworth, O.
Pittsburgh Valve & Fittings Co., Barberton, O.
Powell Co., Wm., Cincinnati, O.
R-S Products Corp., Philadelphia, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc. Reading, Pa.
Rensselaer Valve Co., Cohoes, N. Y.
Scott Valve Mfg. Co., Detroit, Mich.
Semet-Solvay Engineering Corp., New York, N. Y.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GATE, STEEL

Alloy Steel Products Co., Linden, N. J.
American Hard Rubber Co., New York, N. Y.
Bordo Co., Inc., L. J., Glenside, Pa.
Central Brass Mfg. Co., Cleveland, O.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (stainless)
Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Everlasting Valve Co., Jersey City, N. J.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
●Jenkins Bros., New York, N. Y.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Powell Co., Wm., Cincinnati, O.
R-S Products Corp., Philadelphia, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.

VALVES, GLOBE, BRASS AND BRONZE

●American Brass Co., Waterbury, Conn.
American Injector Co., Detroit, Mich.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.

● Advertisement in this issue. See Index to Advertisers, page 326.

Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Chase Brass & Copper Co., Waterbury, Conn.
Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
●Fairbanks Co., New York, N. Y.
●Grinnell Co., Inc., Providence, R. I.
Hammond Brass Wks., Hammond, Ind.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Milwaukee Valve Co., Milwaukee, Wis.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rockford Brass Works, Rockford, Ill.
Scott Valve Mfg. Co., Detroit, Mich.
Stockham Pipe Fittings Co., Birmingham, Ala.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. Y. (Hydraulic service)
White Flo-Matic Corp., Hoosick Falls, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GLOBE, IRON BODY

Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Belfield Co., H., Philadelphia, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Crane Co., Chicago, Ill.
Cyrus Shank Co., Chicago, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Fairbanks Co., New York, N. Y.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Ohio Injector Co., Wadsworth, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Scott Valve Mfg. Co., Detroit, Mich.
Shank Co., Cyrus, Chicago, Ill.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GLOBE, STEEL

Alloy Steel Products Co., Linden, N. J.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Belfield Co., H., Philadelphia, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Clees Valve & Engineering Co., New York, N. Y.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (stainless)
Crane Co., Chicago, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Ostlind Valve, Inc., Portland, Ore.
Parker Appliance Co., Cleveland, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.

VALVES, LINED

American Hard Rubber Co., New York, N. Y. (Hard rubber lined)
Bordo Co., Inc., L. J., Glenside, Pa. (Lead, copper, tin, etc.)
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Goodrich Co., B. F., Akron, O. (Rubber lined)
Hasco Valve & Machine Co., Milwaukee, Wis. (Rubber)
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead or tin)
National Lead Co., New York, N. Y. (Lead)
Northern Indiana Brass Co., Elkhart, Ind. (Tinned)
Resisto Pipe & Valve Co., East Cambridge, Mass. (Lead)
Schutte & Koerting Co., Philadelphia, Pa. (Lead)

VALVES, MIXING, STEAM AND WATER

●Bell & Gossett Co., Morton Grove, Ill.
Boiler Room Equipment, Inc., New York, N. Y.
Central Brass Mfg. Co., Cleveland, O.
Cooper Co., Clark, Philadelphia, Pa.
Dole Valve Co., The, Chicago, Ill.
●Fulton Sylphon Co., Knoxville, Tenn.
General Fittings Co., Providence, R. I.
●Johnson Service Co., Milwaukee, Wis.
Klipfel Mfg. Co., Chicago, Ill.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Leonard Valve Co., Providence, R. I.
●Powers Regulator Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sterling, Inc., Milwaukee, Wis.
Thermo-Mix, Inc., Long Island City, N. Y. (Thermostatic mixing valve for hot and cold water)
Vapor Car Heating Co., Inc., Chicago, Ill.

VALVES, MOTOR OPERATED

Armstrong Heat Control Co., Portland, Ore.
Au-Temp-Co Corp., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
●Bell & Gossett Co., Morton Grove, Ill.
Bristol Co., Waterbury, Conn.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Cooper Co., Clark, Philadelphia, Pa.
Crane Co., Chicago, Ill.
Cutler-Hammer, Inc., Milwaukee, Wis.
Darling Valve & Mfg. Co., Williamsport, Pa.
Davis Regulator Co., Chicago, Ill.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Fairbanks Co., New York, N. Y.
Foxboro Co., Foxboro, Mass.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
Hanlon-Waters, Inc., Tulsa, Okla.
Hasco Valve & Machine Co., Milwaukee, Wis.
Homestead Valve Mfg. Co., Coraopolis, Pa.
●Illinois Engineering Co., Chicago, Ill.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Mason-Neilan Regulator Co., Boston, Mass.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Permutit Co., New York, N. Y.
Philadelphia Gear Works, Inc., Philadelphia, Pa.
Powell Co., Wm., Cincinnati, O.
Preferred Utilities Mfg. Corp., New York, N. Y.
R-S Products Corp., Philadelphia, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schutte & Koerting Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Sterling, Inc., Milwaukee, Wis.
Tallmadge & Co., Webster, East Orange, N. J.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Vapor Car Heating Co., Inc., Chicago, Ill.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
Webster Tallmadge & Co., East Orange, N. J.

VALVES, NEEDLE

●Automatic Products Co., Milwaukee, Wis. (oil)
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Crane Co., Chicago, Ill.
Cyrus Shank Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hanlon-Waters, Inc., Tulsa, Okla.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
●Maid-O'-Mist, Inc., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Parker Appliance Co., Cleveland, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co. Inc., Reading, Pa.

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Schaub Engineering Co., Fred H., Chicago, Ill.
Shank Co., Cyrus, Chicago, Ill.
●Taylor Instrument Companies, Rochester, N. Y.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J. (Hydraulic service)
Williams Valve Co., D. T., Cincinnati, O.

VALVES, PLUG

American Car & Foundry Co., New York, N. Y.
Barrett, Haentjens & Co., Hazleton, Pa.
Barrett Machine Co., N. S., Pittsburgh, Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Crane Co., Chicago, Ill.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Inner-Tite Clamp Corp., Elizabeth, N. J.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., The, Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Merco Nordstrom Valve Co., Pittsburgh, Pa. (Lubricated)
Mueller Co., Decatur, Ill.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Injector Co., Wadsworth, O.
Pittsburgh Brass Mfg. Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Stockham Pipe Fittings Co., Birmingham, Ala.
●Taylor Instrument Companies, Rochester, N. Y.
Walworth Co., New York, N. Y.
White Flo-Matic Corp., Hoosick Falls, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, PRESSURE REDUCING AND REGULATING

●American District Steam Co., North Tonawanda, N. Y.
American Injector Co., Detroit, Mich.
Atlas Valve Co., Inc., Newark, N. J.
Bailey Meter Co., Cleveland, O.
Belfield Co., H., Philadelphia, Pa.
●Bell & Gossett Co., Morton Grove, Ill.
Boylston Steam Specialty Co., Chicago, Ill.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Central Brass Mfg. Co., Cleveland, O.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Clees Valve & Engineering Co., New York, N. Y.
Cooper Co., Clark, Philadelphia, Pa.
Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
●Dunham Co., C. A., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Grove Regulator Co., Oakland, Cal.
Hagan Corp., Pittsburgh, Pa.
Hanlon-Waters, Inc., Tulsa, Okla.
Hubbell Corp., Chicago, Ill.
●Illinois Engineering Co., Chicago, Ill.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Modern Engineering Co., St. Louis, Mo.
Monmouth Products Co., Cleveland, O.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Norgren Co., Inc., C. A., Denver, Colo.
Northern Equipment Co., Erie, Pa.
●Powers Regulator Co., Chicago, Ill.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Republic Flow Meters Co., Chicago, Ill.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Spence Engineering Co., Inc., Walden, N. Y.
Squires Co., C. E., Cleveland, O.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Tallmadge & Co., Webster, East Orange, N. J.
●Taylor Instrument Companies, Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.
Trerice Co., H. O., Detroit, Mich.
Triplex Heating Specialty Co., Peru, Ind.
Tryco Products, Inc., Westfield, Mass.
Vapor Car Heating Co., Inc., Chicago, Ill.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Webster Tallmadge & Co., East Orange, N. J.
White Flo-Matic Corp., Hoosick Falls, N. Y.

VALVES, RADIATOR, AIR

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Anderson Products, Inc., Cambridge, Mass.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Beaton & Corbin Mfg. Co., Southington, Conn.
●Burnham Boiler Corp., Irvington, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Specialty Mfg. Co., Chicago, Ill.
Crane Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Dole Valve Co., The, Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Keeney Mfg. Co., Newington, Conn.
Little Mfg. Co., M. S., Hartford, Conn.
●Maid-O'-Mist, Inc., Chicago, Ill. (Humidifying)
Marsh Corp., Jas. P., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
Monash-Younker Co., Chicago, Ill.
National Metal Products Corp., Chicago, Ill.
New York Air Valve Corp., New York, N. Y.
Ohio Brass Co., Mansfield, O.
Russell & Co., W. A., Bridgeport, Conn.
Scovill Mfg. Co., Waterville Div., Waterville, Conn.
Slater Mfg. Co., Wakefield, Mass.
Sullivan Valve & Engineering Co., Butte, Mont.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, ELECTRIC

Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Electric Valve Mfg. Co., Inc., New York, N. Y.
●Fulton Sylphon Co., Knoxville, Tenn.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Vapor Car Heating Co., Inc., Chicago, Ill.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, PNEUMATIC

American Schaeffer & Budenburg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Powers Regulator Co., Chicago, Ill.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, SELF-CONTAINED

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
American Schaeffer & Budenburg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Au-Temp-Co Corp., New York, N. Y.
Clees Valve & Engineering Co., New York, N. Y.
Edison, Inc., Thos. A., Edison Electrical Controls Div., West Orange, N. J.
●Fulton Sylphon Co., Knoxville, Tenn.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Powers Regulator Co., Chicago, Ill.
Sterling, Inc., Milwaukee, Wis.
Tallmadge & Co., Webster, East Orange, N. J.
●Trane Co., La Crosse, Wis.
Webster Tallmadge & Co., East Orange, N. J.

VALVES, RADIATOR, ORIFICE

●American District Steam Co., North Tonawanda, N. Y.
Au-Temp-Co Corp., New York, N. Y.
Barnes & Jones, Inc., Boston, Mass.
●Bell & Gossett Co., Morton Grove, Ill.
●Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
●Grinnell Co., Inc., Providence, R. I.
●Haines & Co., William S., Philadelphia, Pa.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
Marsh Valve Co,. Dunkirk, N. Y.
Milwaukee Valve Co., Milwaukee, Wis.
New York Air Valve Corp., New York, N. Y.
Ohio Pattern Works & Foundry Co. (Eureka Valve Div), Cincinnati, O.
●Sarco Co., Inc., New York, N. Y.
●Trane Co., La Crosse, Wis.
●Webster & Co., Warren, Camden, N. J.

VALVES, RADIATOR, STEAM AND HOT WATER, HAND

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.

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●Bishop & Babcock Mfg. Co., Cleveland, O.
●Burnham Boiler Corp., Irvington, N. Y.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
●Fairbanks Co., New York, N. Y.
Gorton Heating Corp.. Cranford, N. J.
●Grinnell Co., Inc., Providence, R. I.
●Haines & Co., William S., Philadelphia, Pa.
Hammond Brass Wks., Hammond, Ind.
●Hoffman Specialty Co., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
Marsh Corp., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Fdry. Co., Eureka Valve Div., Cincinnati, O.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Powell Co., Wm., Cincinnati, O.
●Sarco Co., Inc., New York, N. Y.
Scott Valve Mfg. Co., Detroit, Mich.
Sterling, Inc., Milwaukee, Wis.
Stickle Steam Specialities Co., Indianapolis, Ind.
●Trane Co., La Crosse, Wis.
Walworth Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, RADIATOR, STEAM AND HOT WATER, MODULATING

●American District Steam Co., North Tonawanda, N. Y.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Barnes & Jones, Inc., Boston, Mass.
Belknap Mfg. Co., Bridgeport, Conn.
●Bishop & Babcock Mfg. Co., Cleveland, O.
Cashin Co., W. D., Boston, Mass.
Commonwealth Brass Corp., Detroit, Mich.
Crane Co., Chicago, Ill.
Cryer Trap & Valve Co., Inc., New York, N. Y.
●Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
●Fulton Sylphon Co., Knoxville, Tenn.
Gorton Heating Corp., Cranford, N. J.
●Haines & Co., William S., Philadelphia, Pa.
●Hoffman Specialty Co., Inc., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
Ohio Brass Co., Mansfield, O.
Ohio Pattern Wks. & Fdry. Co., Eureka Valve Div., Cincinnati, O.
Pierce Butler Radiator Corp., Syracuse, N. Y.
●Sarco Co., Inc., New York, N. Y.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling, Inc., Milwaukee, Wis.
Tallmadge & Co.. Webster, East Orange, N. J.
●Trane Co., La Crosse, Wis.
Vapor Specialty Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
Webster Tallmadge & Co., East Orange, N. J.

VALVES, REFRIGERATION (ANGLE, CHECK, GATE, GLOBE, NEEDLE, RELIEF)

Ashton Valve Co., Cambridge, Mass.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Belknap Mfg. Co., Bridgeport, Conn.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Central Brass Mfg. Co., Cleveland, O.
Crane Co., Chicago, Ill.
Cyrus Shank Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
Henry Valve Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
●Jenkins Bros., New York, N. Y.
Kerotest Mfg. Co., Pittsburgh, Pa.
●Mueller Brass Co., Port Huron, Mich.
Peerless of America, Inc., Chicago, Ill.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Reynolds Mfg. Co., Inc., Springfield, Mo.
Shank Co., Cyrus, Chicago, Ill.
Superior Valve and Fittings Co., Pittsburgh, Pa.
Triumph Ice Machine Co., Cincinnati, O.
●Vilter Mfg. Co., Milwaukee, Wis.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
Weatherhead Co., Cleveland, O.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, BACK PRESSURE

●Alco Valve Co., St. Louis, Mo.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Burrows Mfg. Co., F. A., York, Pa.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown. Ia.
Electrimatic Corp., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
Hubbell Corp., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
●Mueller Brass Co., Port Huron, Mich.
Temprite Products Corp., Detroit, Mich.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, EXPANSION, CONSTANT PRESSURE

●Alco Valve Co., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Automatic Products Co., Milwaukee, Wis.
●Baker Ice Machine Co., Inc., Omaha, Neb.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown. Ia.
Consolidated Safety Valve Div., Manning, Maxwell & Moore Inc., Bridgeport, Conn.
●Detroit Lubricator Co., Detroit, Mich.
Foster Engineering Co., Newark, N. J.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●Fulton Sylphon Co., Knoxville, Tenn.
Hubbell Corp., Chicago, Ill.
Milwaukee Gas Specialty Co., Milwaukee, Wis.
●Mueller Brass Co., Port Huron, Mich.
Peerless of America, Inc., Chicago, Ill.
X L Refrigerating Co., Chicago, Ill.

VALVES, REFRIGERATION, EXPANSION, THERMOSTATIC

●Alco Valve Co., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Automatic Products Co., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●General Controls Co., Glendale, Cal.
Larkin Coils, Inc., Atlanta, Ga.
Mayson Mfg. Co., Inc., Detroit, Mich.
Milwaukee Gas Specialty Co., Milwaukee, Wis.
●Mueller Brass Co., Port Huron, Mich.
Peerless of America, Inc., Chicago, Ill.
Spoehrer-Lange Co., St. Louis, Mo.
Torrey Refrigeration Products, Los Angeles, Cal.
Voss Co., J. H. H., New York, N. Y.
X L Refrigerating Co., Chicago, Ill.

VALVES, REFRIGERATION, FLOAT, HIGH PRESSURE

●Alco Valve Co., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Foster Engineering Co., Newark, N. J.
●Frick Co., Waynesboro, Pa.
Hubbell Corp., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Mueller Brass Co., Port Huron, Mich.
Phillips & Co., H. A., Chicago, Ill.
Schaub Engineering Co., Fred H., Chicago, Ill.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Temprite Products Corp., Detroit, Mich.
●Vilter Mfg. Co., Milwaukee, Wis.
X L Refrigerating Co., Chicago, Ill.
●York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, MAGNETIC STOP

●Alco Valve Co., St. Louis, Mo.
●Automatic Products Co., Milwaukee, Wis.
Automatic Switch Co., New York, N. Y.
●Detroit Lubricator Co., Detroit, Mich.
Electric Valve Mfg. Co., Inc., New York, N. Y.
Electrimatic Corp., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
●General Controls Co., Glendale, Cal.
Hubbell Corp., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.

● Advertisement in this issue. See Index to Advertisers, page 326.

VALVES, REFRIGERATION, WATER REGULATING, PRESSURE OR TEMPERATURE ACTUATED

Art Valve Co., Chicago, Ill.
●Automatic Products Co., Milwaukee, Wis.
●Cash Co., A. W., Decatur, Ill.
Cyrus Shank Co., Chicago, Ill.
Electrimatic Corp., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Frigidaire Commercial & Air Conditioning Div., General Motor Sales Corp., Dayton, O.
Mercoid Corp., Chicago, Ill.
Mueller Co., Decatur, Ill.
●Mueller Brass Co., Port Huron, Mich.
Penn Electric Switch Co., Goshen, Ind.
Perfection Refrigeration Parts Co., Harvey, Ill.
Phillips & Co., H. A., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Shank Co., Cyrus, Chicago, Ill.
Spence Engineering Co., Inc., Walden, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.

VALVES, RELIEF

Ashton Valve Co., Cambridge, Mass.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
●Bell & Gossett Co., Morton Grove, Ill.
Boylston Steam Specialty Co., Chicago, Ill.
Carpenter & Paterson, Inc., East Boston, Mass.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
●Cochrane Corp., Philadelphia, Pa.
Consolidated Safety Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Fulflo Specialties Co., Inc., The, Blanchester, O. (Oil)
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
●Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Kunkle Valve Co., Ft. Wayne, Ind.
Locke Regulator Co., Salem, Mass.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
●Maid-O'-Mist, Inc., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
Mueller Co., Decatur, Ill.
●Mueller Brass Co., Port Huron, Mich.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Norgren Co., Inc., C. A., Denver, Colo.
Parker Appliance Co., Cleveland, O.
Penberthy Injector Co., Detroit, Mich.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Spencer Thermostat Co., Attleboro, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Swartwout Co., Cleveland, O.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
Triplex Heating Specialty Co., Peru, Ind.
Tryco Products, Inc., Westfield, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
●Watson-Stillman Co., Roselle, N. J. (Hydraulic service)
Watts Regulator Co., Lawrence, Mass.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.

VALVES, RELIEF, FOR HOT WATER HEATING SYSTEMS

●Bell & Gossett Co., Morton Grove, Ill.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.

VALVES, SADDLE

Imperial Brass Mfg. Co., Chicago, Ill.
●Maid-O'-Mist, Inc., Chicago, Ill.
Scovill Mfg. Co., Waterville, Conn.

VALVES, SAFETY

Ashton Valve Co., Cambridge, Mass.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Consolidated Safety Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Foster Engineering Co., Newark, N. J.
Kunkle Valve Co., Ft. Wayne, Ind.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
●McDonnell & Miller, Chicago, Ill.
Scott Valve Mfg. Co., Detroit, Mich.
Walworth Co., New York, N. Y.

VALVES, SOLDER JOINT

●American Brass Co., Waterbury, Conn.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Hammond Brass Works, Hammond, Ind.
●Jenkins Bros., New York, N. Y.
●Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
Scott Valve Mfg. Co., Detroit, Mich.
Walworth Co., New York, N. Y. (Brazed)
Williams Valve Co., D. T., Cincinnati, O.

VALVES, SOLENOID

Albright Equipment Co., Pittsburgh, Pa.
●Alco Valve Co., St. Louis, Mo.
●Anderson Products, Inc., Cambridge, Mass.
Atkins & Co., E. C., Indianapolis, Ind.
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Automatic Switch Co., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Belfield Co., H., Philadelphia, Pa.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
Davis Regulator Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Electric Valve Mfg. Co., Inc., New York, N. Y.
Electrimatic Corp., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
General Sales & Products Co., Cohoes, N. Y.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Guardian Electric Mfg. Co., Chicago, Ill.
Hubbell Corp., Chicago, Ill.
Hunt & Son, C. B., Salem, O.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Milwaukee Gas Specialty Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Penn Electric Switch Co., Goshen, Ind.
Pfening Co., Fred D., Columbus, O.
R-S Products Corp., Philadelphia, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., Inc., New York, N. Y.
Spoehrer-Lange Co., St. Louis, Mo.
Square D Co., Detroit, Mich.
Supreme Electric Products Corp., Rochester, N. Y.
Wheelco Instruments Co., Chicago, Ill.
●White-Rodgers Electric Co., St. Louis, Mo.

VALVES, SPRINKLER SYSTEM CONTROL

●Barber-Colman Co., Rockford, Ill.
Everlasting Valve Co., Jersey City, N. J.
Hodgman Mfg. Co., Taunton, Mass.
Ross Sprinkler Co., Pasadena, Cal.

VALVES, 2, 3, AND 4 WAY

Albright Equipment Co., Pittsburgh, Pa.
●Alco Valve Co., St. Louis, Mo.
●American Brass Co., Waterbury, Conn.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
Belfield Co., H., Philadelphia, Pa.
Bordo Co., Inc., Glenside, Pa.
Bristol Co., Waterbury, Conn.
Carpenter & Paterson, Inc., East Boston, Mass.
●Cash Co., A. W., Decatur, Ill.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
●General Controls Co., Glendale, Cal.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Hunt & Son, C. B., Salem, O.
Imperial Brass Mfg. Co., Chicago, Ill.
Inland Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Johnson Service Co., Milwaukee, Wis.
Kerotest Mfg. Co., Pittsburgh, Pa.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)

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Mercoid Corp., Chicago, Ill.
Merco-Nordstrom Valve Co., Pittsburgh, Pa.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Mueller Brass Co., Port Huron, Mich.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Parker Appliance Co., Cleveland, O.
Penn Electric Switch Co., Goshen, Ind.
Powell Co., Wm., Cincinnati, O.
●Powers Regulator Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schutte & Koerting Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
●Taylor Instrument Companies, Rochester, N. Y.
Walworth Co., New York, N. Y. (Lubricated plug valves)
●Watson-Stillman Co., Roselle, N. J. (Hydraulic service)
Weatherhead Co., Cleveland, O.
Williams Valve Co., D. T., Cincinnati, O.

VANES, DUCT TURNING, PREFABRICATED

Air Devices, Inc., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
●Tuttle & Bailey, Inc., New Britain, Conn.
Waterloo Register Co., Waterloo, Ia.

VAPOR HEATING SYSTEMS

See Systems, Heating, Vapor

VARIABLE SPEED PULLEYS

See Changers, Speed, Mechanical

V-BELT DRIVES

See Drives, V-Belt

VELOCITY REGULATORS

See Regulators, Air Velocity

VENETIAN BLINDS

See Blinds, Venetian

VENTILATORS, MUSHROOM

Aeolus Dickinson, Chicago, Ill.
Best Register Co., Milwaukee, Wis.
●Industrial Sheet Metal Works, Inc., Detroit, Mich.
Knowles Mushroom Ventilator Co., Montclair, N. J.
●Mueller Furnace Co., L. J., Milwaukee, Wis.
●Tuttle & Bailey, Inc., New Britain, Conn.
Ventilating Products Co., Chicago, Ill.

VENTILATORS, ROOF, FAN

Aeolus Dickinson, Chicago, Ill.
Air Controls, Inc., Cleveland, O.
Airmaster Corp., Chicago, Ill.
Akrat Ventilator Co., Chicago, Ill.
Allen Corp., Detroit, Mich.
American Coolair Corp., Jacksonville, Fla.
American-Larson Ventilating Co., Pittsburgh, Pa.
Arex Co., Chicago, Ill.
Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.
Belanger Fan & Blower Co., Detroit, Mich.
Burt Mfg. Co., Akron, O.
Century Fan & Ventilator Co., New York, N. Y.
Chelsea Fan & Blower Co., Irvington, N. J.
Clay Equipment Corp., Cedar Falls, Ia.
Davidson Hy Duty Roof Fan Co., Newton, Mass.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Diehl Mfg. Co., Elizabethport, N. J.
Dual Air Fan Co., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Empire Ventilation Equipment Co., Long Island City, N. Y.
Fingles, Inc., W. A., Baltimore, Md.
Gallaher Co., Owatonna, Minn.
Goethel Co., Alfred C., Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Corp., Grand Rapids, Mich.
Hirschman Co., W. F., Buffalo, N. Y.
Howes-Woods Co., Boston, Mass.
●Ilg Electric Ventilating Co., Chicago, Ill.
●Industrial Sheet Metal Works, Inc., Detroit, Mich.
International Engineering, Inc., Dayton, O.
Iona Ventilator Co., Inc., Philadelphia, Pa.
Johnson Fan & Blower Corp., Chicago, Ill.
Jordan & Co., Paul R., Indianapolis, Ind.
Kernchen Co., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
Klauer Mfg. Co., Dubuque, Ia.
Lohman Co., Wm. J., Irvington, N. J.
Myers Electric Co., Inc., Pittsburgh, Pa.
New York Blower Co., Chicago, Ill.
Penn Ventilating Co., Philadelphia, Pa.
Phoenix Ventilator Co., Inc., Brooklyn, N. Y.
Propellair, Inc., Springfield, O.
Reed Unit-Fans, Inc., New Orleans, La.
Robertson Co., H. H., Pittsburgh, Pa.
Royal Ventilator Co., Philadelphia, Pa.
Schwitzer-Cummins Co., Indianapolis, Ind.
●Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Swartwout Co., Cleveland, O.
Trade-Wind Motorfans, Inc., Los Angeles, Cal.
Truflo Fan Co., Harmony, Pa.
Uno Ventilator Co., Cliftondale, Mass.
Utility Fan Corp., Los Angeles, Cal.
Van Noorden Co., E., Boston, Mass.
Viking Air Conditioning Corp., Cleveland, O.
Washburne & Co., E. G., New York, N. Y.
Waverly Heating Supply Co., Boston, Mass.
Western Engineering & Mfg. Co., Los Angeles, Cal.
●Wing Mfg. Co., L. J., New York, N. Y.

VENTILATORS, ROOF, GRAVITY

Accurate Mfg. Works, Chicago, Ill.
Aeolus Dickinson, Chicago, Ill.
●Airtherm Mfg. Co., St. Louis, Mo.
Akrat Ventilator Co., Chicago, Ill.
Allen Corp., Detroit, Mich.
American-Larson Ventilating Co., Pittsburgh, Pa.
American Metal Products Co., Fort Worth, Texas.
American Sheet Metal Works, New Orleans, La.
Ames Co., W. R., San Francisco, Cal.
Anderson Mfg. Co., Des Moines, Ia.
Arex Co., Chicago, Ill.
Autoforce Ventilating System, Boston, Mass.
Berger Bros. Co., Philadelphia, Pa.
Breidert Co., G. C., Los Angeles, Cal.
Burt Mfg. Co., Akron, O.
Century Fan & Ventilating Co., New York, N. Y.
Chicago Metal Mfg. Co., Chicago, Ill.
Cincinnati Sheet Metal & Roofing Co., Cincinnati, O.
Clay Equipment Corp., Cedar Falls, Ia.
●Day Co., The, Minneapolis, Minn.
Edwards Mfg. Co., Inc., Cincinnati, O.
Empire Ventilation Equipment Co., Long Island City, N. Y.
Fingles, Inc., W. A., Baltimore, Md.
Goethel Co., Alfred C., Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Hirschmann Co., W. F., Buffalo, N. Y.
Howes-Woods Co., Charlestown, Boston, Mass.
●Industrial Sheet Metal Works, Inc., Detroit, Mich.
International Steel Co., Evansville, Ind.
Iona Ventilator Co., Inc., Philadelphia, Pa.
Iwan Brothers, South Bend, Ind.
Jamar Co., Walker, Duluth, Minn.
Jordan & Co., Paul R., Indianapolis, Ind.
Kernchen Co., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
Klauer Mfg. Co., Dubuque, Ia.
Kleenaire Corp., Stevens Point, Wis.
La Crosse Steel Roofing & Corrugating Co., La Crosse, Wis.
Lamneck Products, Inc., Middletown, O.
Lee & Son Co., Thomas, Cincinnati, O.
Leslie Welding Co., Chicago, Ill.
Levow, David, New York, N. Y.
Martin Metal Mfg. Co., Wichita, Kans.
Mellish & Murray Co., Chicago, Ill.
Merchant & Evans Co., Philadelphia, Pa.
Milcor Steel Co., Milwaukee, Wis.
Norman Sheet Metal Mfg. Co., W. F., Nevada, Mo.
Osborn Co., The, J. M. & L. A., Cleveland, O.
Patten Co., J. V., Sycamore, Ill.
Penn Ventilating Co., Philadelphia, Pa.
Phoenix Ventilator Co., Inc., Brooklyn, N. Y.
Pioneer Roofing & Sheet Metal Co., Muskogee, Okla.
Puhl & Hepper Mfg. Co., Inc., St. Louis, Mo.
Robertson Co., H. H., Pittsburgh, Pa.
Royal Ventilator Co., Philadelphia, Pa.
Rynicker Sheet Metal Works, Inc., Billings, Mont.
St. Paul Corrugating Co., St. Paul, Minn.
Schoedinger, F. O., Columbus, O.
Sheet Metal Mfg. Co., Inc., Brooklyn, N. Y.
Southbridge Roofing Co., Inc., Southbridge, Mass.
Southern States Iron Roofing Co., Savannah, Ga.
Swartwout Co., Cleveland, O.
Tierney Rotor Ventilator Co., Minneapolis, Minn.
Tiffin Eaves Trough Co., Tiffin, O.
Uno Ventilator Co., Cliftondale, Mass.
Van Noorden Co., E. Boston, Mass.
Walker Jamar Co., Duluth, Minn.
Western Engineering & Mfg. Co., Los Angeles, Cal.
Willis Steel Corp., Galesburg, Ill.
York Corrugating Co., York, Pa.

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VENTILATORS, UNIT

- ●Airtherm Mfg. Co., St. Louis, Mo.
- Johnson Fan & Blower Corp., Chicago, Ill.
- Nelson Corp., Herman, Moline, Ill.
- ●Nesbitt, Inc., John J., Philadelphia, Pa.
- New York Blower Co., Chicago, Ill.
- Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
- ●Sturtevant Co., B. F., Boston, Mass.
- ●Trane Co., La Crosse, Wis.

VIBRATION ELIMINATORS

See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration

VIBRATION ISOLATORS

See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration

VISCOUS LIQUID PUMPS

See Pumps, Viscous Liquids

VISES, PIPE

- American Pipe Tool Co., Chicago, Ill.
- Armstrong Bros. Tool Co., Chicago, Ill.
- Armstrong Mfg. Co., Bridgeport, Conn.
- Beaver Pipe Tools, Inc., Warren, O. (Sawing—for tubing)
- Billings & Spencer Co., Hartford, Conn.
- Crown Die & Tool Co., Chicago, Ill.
- Desmond-Stephen Mfg. Co., Urbana, Ill.
- Erie Tool Wks., Erie, Pa.
- Greenfield Tap & Die Corp., Greenfield, Mass.
- Hollands Mfg. Co., Erie, Pa.
- International Nutyp Tool Co., Oswego, N. Y.
- Jarecki Mfg. Co., Erie Pa.
- Nye Tool & Machine Wks., The, Chicago, Ill.
- Ridge Tool Co., Elyria, O.
- Toledo Pipe Threading Machine Co., Toledo, O.
- Trimont Mfg. Co., Roxbury, Mass.
- Vanderman Mfg. Co., Willimantic, Conn.
- ●Williams & Co., J. H., New York, N. Y.
- Yost Mfg. Co., Meadville, Pa.

VISE STANDS

See Stands, Pipe Vise

WALL THERMOSTATS

See Thermostats, Room or Wall

WARM AIR FURNACES

See Furnaces, Warm Air

WASHERS, AIR

- ●Air & Refrigeration Corp., New York, N. Y.
- Airwasher Corp., Lansing, Mich.
- American Blower Corp., Detroit, Mich.
- Ames Co., W. R., San Francisco, Cal.
- Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
- Ballantyne Co., Omaha, Neb.
- Bayley Blower Co., Milwaukee, Wis.
- Betz Air Conditioning Corp., Kansas City, Mo.
- ●Bishop & Babcock Mfg. Co., Cleveland, O.
- Blower Application Co., Milwaukee, Wis.
- ●Buffalo Forge Co., Buffalo, N. Y.
- Carrier Corp., Syracuse, N. Y.
- ●Clarage Fan Co., Kalamazoo, Mich.
- Columbus Heating & Ventilating Co., Columbus, O.
- Electrovent Fan & Mfg. Co., Chicago, Ill.
- ●Industrial Sheet Metal Works, Inc., Detroit, Mich.
- McLouth Air Conditioning Corp., Lansing, Mich.
- Mellish & Murray Co., Chicago, Ill.
- ●Murray Mfg. Co., D. J., Wausau, Wis.
- New York Blower Co., Chicago, Ill.
- Niagara Blower Co., New York, N. Y.
- Northern Blower Co., Cleveland, O.
- Parks-Cramer Co., Fitchburg, Mass.
- Phillips Cooling Tower Co., Inc., New York, N. Y.
- Ross Sprinkler Co., Pasadena, Cal.
- Spray Engineering Co., Somerville, Mass.
- Spray-Wheel Air Conditioners, Inc., Denver, Colo.
- Strandwitz & Co., Inc., W. J., Camden, N. J.
- ●Sturtevant Co., B. F., Boston, Mass.
- Supreme Heater & Ventilating Corp., St. Louis, Mo.
- Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
- ●Trane Co., La Crosse, Wis.
- ●U. S. Air Conditioning Corp., Minneapolis, Minn.
- Utility Fan Corp., Los Angeles, Cal.
- ●Vilter Mfg. Co., Milwaukee, Wis.
- Western Blower Co., Seattle, Wash.
- ●York Ice Machinery Corp., York, Pa.

WATER CHILLERS

See Chillers, Water, for Air Conditioning and Refrigeration

WATER HEATERS

See Heaters, Indirect, Submerged; Heaters, Water

WATER METERS

See Meters, Water

WATER TREATMENT

- Activator Process Sales Co., Alhambra, Cal.
- ●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- American K. A. T. Corp., New York, N. Y.
- American Water Softener Co., Philadelphia, Pa.
- American Well Works, Aurora, Ill.
- Aquatic Chemical Laboratories, Inc., New York, N. Y.
- Automatic Pump & Softener Corp., Rockford, Ill.
- Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
- Cannon Chemical Co., Everett, Mass.
- ●Cochrane Corp., Philadelphia, Pa.
- Continental Products Co., Euclid, O.
- Dampney Co. of America, Boston, Mass.
- Dearborn Chemical Co., Chicago, Ill.
- Electroaire Corp., Chicago, Ill.
- Elgin Softener Corp., Elgin, Ill.
- Ferro-Nil Corp., New York, N. Y.
- Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
- Graver Tank & Mfg. Co., Inc., East Chicago, Ind.
- Grief, Edward C., Bogota, N. J.
- Haering Co., D. W., Chicago, Ill.
- Hagan Corp., Pittsburgh, Pa.
- Maintenance Engineering Corp., Houston, Tex.
- Metropolitan Refining Co., Long Island City, N. Y.
- Monsanto Chemical Co., Organic Chemicals Div., St. Louis, Mo.
- Mutual Chemical Co. of America, New York, N. Y.
- National Aluminate Corp., Chicago, Ill.
- North American Fibre Products Co., The, Cleveland, O.
- Norwood Filtration Co., The, Florence, Mass.
- Oakite Products, Inc., New York, N. Y.
- % Proportioneers, Inc., %, Providence, R. I.
- Permutit Co., New York, N. Y.,
- R. U. V. Engineering Corp., New York, N. Y.
- Red Jacket Mfg. Co., Davenport, Ia.
- Refinite Corp., Omaha, Nebr.
- ●Research Products Corp., Madison, Wis.
- Solvay Sales Corp, New York, N. Y.
- Sudbury Laboratory, South Sudbury, Mass.
- Una-Soft Water Softener Co., Springfield, O.
- Uniflow Mfg. Co., Erie, Pa.
- Vinco Co., Inc., The, New York, N. Y.
- Wallace & Tiernan Co., Inc., Belleville, N. J.
- Warlo Corp., New York, N. Y.
- Water Refining Co., Ft. Wayne, Ind.
- Western Chemical Co., Kansas City, Mo.

WATER VAPOR REFRIGERATION

See Compressors, Refrigerating, Centrifugal; and Compressors, Refrigerating, Steam Jet

WELDERS, ARC

- ●Air Reduction Sales Co., New York, N. Y.
- Allied Welding Crafts, Inc., Indianapolis, Ind.
- ●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- Alter-Arc Mfg. Co., Lawton, Okla.
- Bear Mfg. Co., Rock Island, Ill.
- Borm Mfg. Co., Elgin, Ill.
- Burke Electric Co., Erie, Pa.
- Commonwealth Electric Welder Mfg. Co., Philadelphia, Pa.
- Eisler Engineering Corp., Newark, N. J.
- Electric Arc, Inc., Newark, N. J.
- Emerson Electric Mfg. Co., The, St. Louis, Mo.
- Ergolyte Mfg. Co., Philadelphia, Pa.
- Fern, Ralph, Scranton, Pa.
- ●General Electric Co., Schenectady, N. Y.
- General Equipment Co., Wichita, Kan.
- Giant Grip Mfg. Co., Oshkosh, Wis.
- Hammett Mfg. Co., Kansas City, Mo.
- Hampton Electric Mfg. Co., Pittsburgh, Pa.
- Harnischfeger Corp., Milwaukee, Wis.
- Hobart Bros., Troy, O.

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Hollup Corp., Div. of National Cylinder Gas Co., Chicago, Ill.
Ideal Commutator Dresser Co., Sycamore, Ill.
Ideal Electric & Mfg. Co., Mansfield, O.
Imperial Electric Co., Akron, O.
Lee & Son Co., K. O., Aberdeen, S. D.
Lincoln Electric Co., Cleveland, O.
Maple Valley Mfg. Co., Mapleton, Ia.
Marquette Mfg. Co., Minneapolis, Minn.
Miller Electric Mfg. Co., Inc., Appleton, Wis.
Owen-Dyneto Corp., Syracuse, N. Y.
Sight Feed Generator Co., Richmond, Ind.
Smith Welding Equipment Corp., Minneapolis, Minn.
Star Electric Motor Co., Bloomfield, N. J.
Trindl Products, Ltd., Chicago, Ill.
Una Welding, Inc., Cleveland, O.
Universal Power Corp., Cleveland, O.
Welding Apparatus Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Will-Weld Mfg. Co., Inc., Omaha, Neb.
Wilson Welder & Metals Co., Inc., New York, N. Y.

WELDERS, SPOT

Acme Electric Welder Co., Los Angeles, Cal.
Agnew Electric Co., Milford, Mich.
Alphil Spot Welding Co., New York, N. Y.
Dyer Welder & Engineering Co., Kansas City, Mo.
Eisler Engineering Corp., Newark, N. J.
Electric Arc, Inc., Newark, N. J.
Federal Machine & Welder Co., Warren, O.
Micro Products Co., Chicago, Ill.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Taylor-Hall Welding Corp., Worcester, Mass.
Taylor-Winfield Corp., Warren, O.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Universal Power Corp., Cleveland, O.
Weldex, Inc., Detroit, Mich.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

WELDING AND CUTTING APPARATUS. OXY-ACETYLENE

●Air Reduction Sales Co., New York, N. Y.
Burdett Mfg. Co., Chicago, Ill.
Dockson Corp., Detroit, Mich.
Gasweld Equipment Co., Chicago, Ill.
Harris Calorific Co., The, Cleveland, O.
Imperial Brass Mfg. Co., Chicago, Ill.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Milburn Co., Alexander, Baltimore, Md.
Modern Engineering Co., St. Louis, Mo.
National Cylinder Gas Co., Chicago, Ill.
Ransome Concrete Machinery Co., Dunellen, N. J. (welding positioner)
Smith Welding Equipment Corp., Minneapolis, Minn.
Tempil Corp., New York, N. Y. (temperature indicators)
Torchweld Equipment Div., National Cylinder Gas Co., Chicago, Ill.
Universal Power Corp., Cleveland, O.

WELDING FUME COLLECTORS

See Collectors, Welding Fume

WELDING PIPE CLAMPS

See Clamps, Pipe, Welding

WELDING RINGS

See Rings, Welding

WELDING ROD

See Rod, Gas Welding

WHEELS, BLOWER

Advance Aluminum Castings Corp., Chicago, Ill.
Air Controls, Inc., Cleveland, O.
American Blower Corp., Detroit, Mich.
Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
●Bishop & Babcock Mfg. Co., Cleveland, O.
Champion Blower & Forge Co., Lancaster, Pa.
●Clarage Fan Co., Kalamazoo, Mich.
Economy Electric Mfg. Co., Chicago, Ill.
Hastings Air Conditioning Co., Hastings, Neb.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Janette Mfg. Co., Chicago, Ill.
Lau Blower Co., Dayton, O.
Morrison Products, Inc., Cleveland, O.
New York Blower Co., Chicago, Ill.
Palmer's Mfg. Corp., Phoenix, Ariz.
Peerless Electric Co., Warren, O.
Schwitzer-Cummins Co., Indianapolis, Ind.
●Sturtevant Co., B. F., Boston, Mass.
●Torrington Mfg. Co., Torrington, Conn.
Triangle Mfg. Co., Oshkosh, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Viking Air Conditioning Corp., Cleveland, O.
Western Blower Co., Seattle, Wash.

WHITE PRINT MACHINES

See Machines, Blue Print and White Print

WINDOW VENTILATOR AND FILTER UNITS

See Units, Window Ventilator and Filter

WINDOWS, HEAT INSULATING

Advance Insulating Co., Pittsburgh, Pa.
Andersen Corp., Bayport, Minn.
Chamberlin Metal Weather Strip Co., Detroit, Mich.
Detroit Steel Products Co., Detroit, Mich.
Kane Mfg. Corp., Kane, Pa.
Libbey-Owens Ford Glass Co., Toledo, O.
Mississippi Glass Co., New York, N. Y.
Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Russell Co., F. C., Cleveland, O.
Truscon Steel Co., Youngstown, O.

WOOD PIPE

See Pipe, Wood

WRENCHES, ADJUSTABLE

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Bonney Forge & Tool Works, Allentown, Pa.
Crescent Tool Co., Jamestown, N. Y.
Erie Tool Works, Erie, Pa.
Peck, Stow & Wilcox Co., Southington, Conn.
Snap-On Tools Corp., Kenosha, Wis.
Trimont Mfg. Co., Boston, Mass.

WRENCHES, OPEN END

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Blackhawk Mfg. Co., Milwaukee, Wis.
Bonney Forge & Tool Works, Allentown, Pa.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., New York, N. Y.

WRENCHES, PIPE

Armstrong Bros. Tool Co., Chicago, Ill.
Bernz Co., Inc., Otto, Rochester, N. Y.
Billings & Spencer Co., Hartford, Conn.
Bonney Forge & Tool Works, Allentown, Pa.
Erie Tool Works, Erie, Pa.
Greene, Tweed & Co., New York, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
International Nutyp Tool Co., Oswego, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Ridge Tool Co., Elyria, O.
Snap-On Tools Corp., Kenosha, Wis.
Trimont Mfg. Co., Boston, Mass.
USHCO Mfg. Co., Inc., Buffalo, N. Y.
Walworth Co., New York, N. Y.

WRENCHES, RATCHET

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Blackhawk Mfg. Co., Milwaukee, Wis.
Bonney Forge & Tool Works, Allentown, Pa.
Dresser Mfg. Co., Bradford, Pa.
Greene, Tweed & Co., New York, N. Y.
Lowell Wrench Co., Worcester, Mass.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., New York, N. Y.

WRENCHES, SOCKET

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co, Hartford, Conn.
Blackhawk Mfg. Co., Milwaukee, Wis.
Bonney Forge & Tool Works, Allentown, Pa.
Chicago Pneumatic Tool Co., New York, N. Y. (pneumatic)
Lowell Wrench Co., Worcester, Mass.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., New York, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 326.

WRENCHES, TORQUE INDICATING

Automotive Maintenance Machinery Co., North Chicago, Ill.
Blackhawk Mfg. Co., Milwaukee, Wis.
Bonney Forge & Tool Works, Allentown, Pa.
Dresser Mfg. Co., Bradford, Pa.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., New York, N. Y.

WROUGHT IRON PIPE

See Pipe, Wrought Iron

WROUGHT IRON SHEETS

See Sheets, Wrought Iron

X-RAY MACHINES AND FILM

See Machines and Film, X-Ray

ZINC SHEETS

See Sheets, Zinc

ZONE CONTROLS

See Systems, Heating, Zone Control

● Advertisement in this issue. See Index to Advertisers, page 326.

DIRECTORY SECTION

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS

PART 2—TRADE NAMES

A-B—Motor controllers. Allen-Bradley Co., Milwaukee, Wis.

ABC—Humidifiers. American Blower Corp., Detroit, Mich.

AGP—Heaters. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

A-P—Damper operators, regulators, strainers, thermostats, valves. Automatic Products Co., Milwaukee, Wis.

ARRC—Fittings. Union Metal Wks., Inc., Chelsea, Mass.

Abrasoweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Absorbex—Insulation. Celotex Corp., The, Chicago, Ill.

Ace—Pipe, pipe and fittings, tanks, valves, pumps. American Hard Rubber Co., New York, N. Y.

Ace—Welders. Pier Equipment Mfg. Co., Benton Harbor, Mich.

Acme—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Acme—Louvers and shutters. Elgo Shutter & Mfg. Co., Detroit, Mich.

Acousteel—Insulation. Celotex Corp., The, Chicago, Ill.

Acousti-Celotex—Insulation. Celotex Corp., The, Chicago, Ill.

Acoustilite—Insulation. Insulite Co., Minneapolis, Minn.

Acratherm—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Adamant—Fire brick cement. Botfield Refractories Co., Philadelphia, Pa.

Ada-Stic — Insulating cement. Botfield Refractories Co., Philadelphia, Pa.

Adjustiblade—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Adjusto—Packing. Keasbey & Mattison Co., Ambler, Pa.

Adjust-O-Feeder—Pumps, water treatment. % Proportioneers, Inc. %, Providence, R. I.

Adjustor — Heating systems. Kehm Corp., The, Chicago, Ill.

Adsco—Conduit, heaters, joints, meters, pipe, pipe hangers and supports, pipe protectors, separators, strainers, regulators, valves. American District Steam Co., North Tonawanda, N. Y.

Adsco Rotary—Condensation meters. American District Steam Co., North Tonawanda, N. Y.

Adsco Vertical—Traps. American District Steam Co., North Tonawanda, N. Y.

Aeracool—Blades, fans, louvers and shutters, ventilators. Myers Electric Co., Inc., Pittsburgh, Pa.

Aerisweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Aero—Roof ventilators. Jordan & Co., Paul R., Indianapolis, Ind.

Aero-Art—Radiation. National Radiator Co., The, Johnstown, Pa.

Aerocrat—Fans, washers. Ames Co., W. R., San Francisco, Cal.

Aerofuse — Air diffusers. Tuttle & Bailey, Inc., New Britain, Conn.

Aeroplane—Roof ventilators. Jordon & Co., Paul R., Indianapolis, Ind.

Aeroplex—Fans. Bayley Blower Co., Milwaukee, Wis.

Aeropull—Roof ventilators. Jordan & Co., Paul R., Indianapolis, Ind.

Aerovalve—Ventilators. Knowles Mushroom Ventilator Co., Montclair, N. J.

Afco—Fans, heaters. American Furnace Co., St. Louis, Mo.

Affco—Grilles, hangers, louvers and shutters. American Foundry & Furnace Co., Bloomington, Ill.

Agitair—Air diffusers, grilles, furnaces, heaters, heating systems, vanes. Air Devices, Inc., New York, N. Y.

Air Beam—Fans. Hall Mfg. Co., Cedar Rapids, Ia.

Air Lader—Louvers and shutters. Guth Co., Edwin F., St. Louis, Mo.

Air Stone—Conduit. Dockstader, S. E., Washington, D. C.

Air Vane—Grilles, registers. Rock Island Register Co., Rock Island, Ill.

Air Control—Bearings, fans, heaters, unit coolers and air conditioners. Hastings Air Conditioning Co., Hastings, Neb.

Air-Acoustic—Insulation. Johns-Manville, New York, N. Y.

Air-A-Way—Ventilators. American Metal Products Co., Fort Worth, Tex.

Airblanket—Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Airco—Welding rod, solder, pipe cutting machines. Air Reduction Sales Co., New York, N. Y.

Air-Con—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Airefiner—Water treatment. Oakite Products, Inc., New York, N. Y.

Airex—Fans, louvers and shutters, unit air conditioners. Mountain States Equipment Co., Denver, Colo.

Air-Fan—Window ventilator units. Ad-Lee Co., Inc., Chicago, Ill.

Air-flo—Louvers and shutters. Belanger Fan & Blower Co., Detroit, Mich.

Air-flo—Dampers, louvers and shutters. Air Conditioning Products Co., Detroit, Mich.

Airfoil—Fans, fan blades. Aerovent Fan Co., Piqua, O.

Airguide—Hygrometers, thermometers. Fee and Stemwedel, Inc., Chicago, Ill.

Airheator—Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Airistocrat — Fan blades. Torrington Mfg. Co., Torrington, Conn.

Airkem—Odor adsorbers. Airox Co., New York, N. Y.

Airline—Grilles, registers. Tuttle & Bailey, Inc., New Britain, Conn.

Airmat Arrester—Dust collectors. American Air Filter Co., Inc., Louisville, Ky.

Airmixt—Gas and oil burners. Williams, Inc., F. C., Dearborn, Mich.

Airofelt — Insulation. Johns-Manville, New York, N. Y.

Airo-Flex—Registers. Auer Register Co., Cleveland, O.

Air-o-Line — Indicator-controllers, recorder-controllers. Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

Air-O-Matic—Refrigerating machines. Williams Oil-O-Matic Corp., Bloomington, Ill.

Airotherm—Zone control thermostat. Tallmadge & Co., Webster, East Orange, N. J.

Airotor—Blower wheels. Torrington Mfg. Co., Torrington, Conn.

Airplex—Air filters. Davies Air Filter Corp., New York, N. Y.

Airstat — Regulators. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Airstream—Air filters. Brauer Supply Co., A. G., St. Louis, Mo.

Airstream—Blower wheels, fans. Morrison Products, Inc., Cleveland, O.

Airswitch—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Airvector—Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Air-Vent—Fans. Airtherm Mfg. Co., St. Louis, Mo.

Air-X-Hausters—Roof ventilators. Breidert Co., G. C., Los Angeles, Cal.

Airxpel—Steam traps. Wright-Austin Co., Detroit, Mich.

Akon—Water treatment. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Alco—Ventilators. Allen Corp., Detroit, Mich.

Alcoa—Angles, electrodes, sheets, tanks, tubing. Aluminum Co. of America, Pittsburgh, Pa.

Alkalex—Water treatment. Research Products Corp., Madison, Wis.

Allvent—Propeller fans. Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.

Alnor—Thermometers, air velocity meters. Illinois Testing Laboratories, Chicago, Ill.

Aloyco—Stainless steel fittings, nipples, pipe, tubing, unions, valves. Alloy Steel Products Co., Linden, N. J.

Alternarc—Arc welders. Electric Arc, Inc., Newark, N. J.

Aluminweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Always Reliable — Benders, cutters, leak detectors, torches, wrenches. Bernz Co., Inc., Otto, Rochester, N. Y.

Ambler—Cement. Keasbey & Mattison Co., Ambler, Pa.

Amco—Galvanizing powder. American Solder & Flux Co., Philadelphia, Pa.

Amco—Humidifiers, humidistats, hygrometers. American Moistening Co., Providence, R. I.

Amco—Packing. Austin-Mason Co., New York, N. Y.

American—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

American—Furnaces. American Foundry & Furnace Co., Bloomington, Ill.

American—Speed reducers. American Pulley Co., Philadelphia, Pa.

American—Vibration eliminators. American Metal Hose Branch, American Brass Co., Waterbury, Conn.

American — Pumps, water treatment. American Well Works, Aurora, Ill.

American—Pipe benders. American Pipe Bending Machine Co., Inc., Boston, Mass.

American — Water heaters. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Ames—Pumps. Domestic Engine & Pump Co., Shippensburg, Pa.

Ames-Unaflow—Steam engines. Pierce Butler Radiator Corp., Syracuse, N. Y.

Amirglass — Filters. Amirton Co., New York, N. Y.

Ammco—Wrenches. Automotive Maintenance Machinery Co., North Chicago, Ill.

Ammonoduct—Pipe. Bethlehem Steel Co., Bethlehem, Pa.

Anaconda—Fittings, pipe, welding rod, sheets, solder, tubing, valves. American Brass Co., Waterbury, Conn.

Anchor—Insulation. Celotex Corp., The, Chicago, Ill.

Anemo-light—Air diffusers. Anemostat Corp. of America, New York, N. Y.

Anemo-trol—Air diffusers. Anemostat Corp. of America, New York, N. Y.

Ankorite—Packing. Anchor Packing Co., Philadelphia, Pa.

Anode—Electrodes. Lincoln Electric Co., Cleveland, O.

Anti-Sweat — Insulation. Johns-Manville, New York, N. Y.

Apex—Pipe cutting and threading machines. Merrell Mfg. Co., Toledo, O.

Apex—Quadrants. Ohio Products Co., Cleveland, O.

Apex—Recorders. Uehling Instrument Co., Paterson, N. J.

Aqua-Clear—Water treatment. Sudbury Laboratory, South Sudbury, Mass.

Aqualator—Circulators. Triplex Mfg. Co., Peru, Ind.

Aquaseal—Cement and compounds. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Aquazone—Humidifiers. Coroaire Heater Corp., The, Cleveland, Ohio.

Aqulux—Heaters. Johnson Co., S. T., Oakland, Cal.

Arc-Eng—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Arco—Boilers, hangers, humidifiers, plates, radiation, regulators, valves. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Arex-Austor—Roof ventilators. Arex Co., Chicago, Ill.

Aridifier—Separators. Logan Engineering Co., Chicago, Ill.

Arin—Louvers and shutters. Arex Co., Chicago, Ill.

Aristocrat—Registers. Auer Register Co., Cleveland, O.

Armco—Pipe, sheets. American Rolling Mill Co., The, Middletown, O.

Armorak—Insulation. Keasbey Co., Robert A., New York, N. Y.

Arrow — Ventilators. Uno Ventilator Co., Cliftondale, Mass.

Arrowtrol—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Artic—Refrigerants. du Pont de Nemours & Co., E. I., R. & H. Chemicals Dept., Wilmington, Del.

Asbestocel—Insulation. Johns-Manville, New York, N. Y.

Asco—Valves, relays, switches. Automatic Switch Co., New York, N. Y.

Atlas—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Atticvane—Fans. Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Autocrat—Fan blades. Torrington Mfg. Co., Torrington, Conn.

Auto-Klean—Filters, strainers. Cuno Engineering Corp., Meriden, Conn.

Automatic — Motor bases. Ideal Commutator Dresser Co., Syracuse, Ill.

Automatic—Tube cleaners. Albright Equipment Co., Pittsburgh, Pa.

Auto-Tite—Pipe couplings. Superior Railway Products Corp., Pittsburgh, Pa.

Autovent — Eliminators, humidifiers, valves. Maid-O-Mist, Inc., Chicago, Ill.

Autozone—Zone control unit. Tallmadge & Co., Webster, East Orange, N. J.

Axiflo—Propeller fans. Sturtevant Co., B. F., Boston, Mass.

Axiom—Filters. Blocksom & Co., Michigan City, Ind.

BAC—Unit heaters. Surface Combustion Corp., Toledo, O.

B & B—Heating and air conditioning equipment. Bishop & Babcock Mfg. Co., Cleveland, O.

B. B.—Electric motors. Brown-Brockmeyer Co., Dayton, O.

BCA—Bearings. Bearings Co. of America, Lancaster, Pa.

B & C—Plates. Beaton & Corbin Mfg. Co., Southington, Conn.

B. & G. — Chillers, circulators, condensers, heaters, regulators, tanks, thermostats, valves. Bell & Gossett Co., Morton Grove, Ill.

B/W—Controllers, cut-offs, relays, switches. Bender Warrick Corp., Birmingham, Mich.

B & W—Boilers, burners, tubing, stokers, valves. Babcock & Wilcox Co., New York, N. Y.

Badger—Time switches. Reliance Automatic Lighting Co., Racine, Wis.

Balancer—Heating systems. Automatic Temperature Control Co., Inc., Philadelphia, Pa.

Balsam-Wool—Insulation. Wood Conversion Co., St. Paul, Minn.

Bankheat—Oil burners. Johnson Co., S. T., Oakland, Cal.

Barcol—Humidistats, motors, operators, regulators, thermostats, valves. Barber-Colman Co., Rockford, Ill.

Barnes—Cutters. Erie Tool Works, Erie, Pa.

Barry—Bearings. Dick Co., Inc., R. & J., Passaic, N. J.

Barton-American — Pumps. American-Marsh Pumps, Inc., Battle Creek, Mich.

Battery—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Beacor—Valves. Beaton & Corbin Mfg. Co., Southington, Conn.

Bell—Cement. Keasbey & Mattison Co., Ambler, Pa.

Belt-Air—Propeller fans. Belco Exhaust Fan Mfg. Co., St. Louis, Mo.

Beneco—Oil burners. Bennett Co., Omaha, Neb.

Benton—Boilers. Combination Boiler Co., Benton Harbor, Mich.

Beth-Co-Weld—Pipe. Bethlehem Steel Co., Bethlehem, Pa.

Beth-Cu-Loy—Sheets. Bethlehem Steel Co., Bethlehem, Pa.

Bettendorf—Oil burners. Micro-Westco, Inc., Bettendorf, Ia.

Big Midget—Soot blowers. Sturtevant Co., B. F., Boston, Mass.

Bildrite—Insulation. Insulite Co., Minneapolis, Minn.

Billmyre—Air compressors. Allen Billmyre Corp., Mamaroneck, N. Y.

Binoc—Thermometers. Taylor Instrument Companies, Rochester, N. Y.

Birm — Water treatment. Research Products Corp., Madison, Wis.

Bison—Boilers. Farrar & Trefts, Buffalo, N. Y.

Bitugloss — Lacquers and enamels. Wailes Dove-Hermiston Corp., Westfield, N. J.

Bitumastic—Protective coatings. Wailes Dove-Hermiston Corp., Westfield, N. J.

Bloapco—Dust collectors. Blower Application Co., Milwaukee, Wis.

Blue-Point—Drills, tools, wrenches. Snap-On Tools Corp., Kenosha, Wis.

Blue Ribbon—Hangers or brackets, nipples, plates. Chicago Nipple Mfg. Co., Chicago, Ill.

Branford—Unions. Malleable Iron Fittings Co., Branford, Conn.

Brazarc—Electrodes. Universal Power Corp., Cleveland, O.

Brazo—Solder. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Breeze Spreader—Propeller fans. Victor Electric Products, Inc., Cincinnati, O.

Breezo—Fans. Buffalo Forge Co., Buffalo, N. Y.

Bro-For — Boiler compounds. Brown-Ford Corp., Newton, Mass.

Broomell—Eliminators, floats, heating systems, traps, valves. Vapor Specialty Co., New York, N. Y.

BTUnit—Unit heaters. Industrial Mfg. & Engineering Co., Chicago, Ill.

Buf-flow—Propeller fans. Buffalo Forge Co., Buffalo, N. Y.

Bull Dog—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Bull Pup—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Burco—Welding apparatus. Burdett Mfg. Co., Chicago, Ill.

Burnham — Compressors, condensers, pumps. Union Steam Pump Co., Battle Creek, Mich.

C-E—Boilers. Combustion Engineering Co., New York, N. Y.

C-H—Controllers and starters, heaters, relays, switches, valves. Cutler-Hammer, Inc., Milwaukee, Wis.

CJB—Bearings. Ahlberg Bearing Co., Chicago, Ill.

C & M—Hangers or brackets. Carty & Moore Engineering Co., Detroit, Mich.

C. N. I.—Pipe, welding rod. Walworth Co., New York, N. Y.

COM—Blowers. Wing Mfg. Co., L. J., New York, N. Y.

CW—Pipe. Spang Chalfant, Inc., Div. of National Supply Co., Pittsburgh, Pa.

Cadillac—Meters. Central Station Steam Co., Detroit, Mich.

Cadman—Valves. Barrett Machine Co., N. S., Pittsburgh, Pa.

Cadwell—Pressure regulators, valves. Beaton & Cadwell Mfg. Co., New Britain, Conn.

Calicel—Insulation. Celotex Corp., The, Chicago, Ill.

Calistone—Insulation. Celotex Corp., The, Chicago, Ill.

Calktite—Cement and compounds. U. S. Stoneware Co., New York, N. Y.

Caloride—Dehumidifiers. Solvay Sales Corp., New York, N. Y.

Calorider—Dehumidifiers. General Air Conditioning Corp., Cincinnati, O.

Calorider—Dehumidifiers, humidifiers, unit air conditioners. Research Corp., New York, N. Y.

Cameo—Radiation. Weil-McLain Co., Chicago, Ill.

Cantilever—Hygrometers. Standard Thermometer, Inc., Boston, Mass.

Capillary—Air washers, dehumidifiers. Air & Refrigeration Corp., New York, N. Y.

Capitol—Boilers, hangers or brackets, heaters, radiation. United States Radiator Corp., Detroit, Mich.

Capitol—Insulation. Standard Lime & Stone Co., Baltimore, Md.

Capitolaire—Unit air conditioners. United States Radiator Corp., Detroit, Mich.

Carbo-Cooler—Cooling surface. Mojonnier Bros. Co., Chicago, Ill.

Careyduct—Ducts and duct fittings. Carey Mfg. Co., Philip, Cincinnati, O.

Cascade—Unit air conditioners. Todd Air Conditioning Co., Inc., Bonner Springs, Kans.

Casey-Hedges—Boilers. Combustion Engineering Co., Inc., New York, N. Y.

Castirnarc—Electrodes. Universal Power Corp., Cleveland, O.

Cataract—Centrifugal pumps. Red Jacket Mfg. Co., Davenport, Ia.

Catawissa—Unions, valves. Central Forging Co., Catawissa, Pa.

Causul—Valves. Lunkenheimer Co., Cincinnati, O.

Cell-U-Blanket—Insulation. Masonite Corp., Chicago, Ill.

Celoron—Couplings. Continental Diamond Fibre Co., Newark, Del.

Cemesto—Insulation. Celotex Corp., The, Chicago, Ill.

Centri-Jet—Centrifugal pumps. Red Jacket Mfg. Co., Davenport, Ia.

Centrimax—Meters. Leeds & Northrup Co., Philadelphia, Pa.

Centripac—Packing. Johns - Manville, New York, N. Y.

Centripeller—Roof ventilators. Jordan & Co., Paul R., Indianapolis, Ind.

Chaco—Cement and compounds, boiler and radiator sealing compounds. Desolvo Co., The, Pittsburgh, Pa.

Champion—Furnaces, heaters. National Heating Co., Minneapolis, Minn.

Champion—Pipe wrenches. Greene, Tweed & Co., New York, N. Y.

Charavay—Propeller fans, unit heaters. Hartzell Propeller Fan Co., New York, N. Y.

Charm—Radiation. Thatcher Furnace Co., Newark, N. J.

Chevron—Packing. Garlock Packing Co., Palmyra, N. Y.

Chicago—Brakes. Dreis & Krump Mfg. Co., Chicago, Ill.

Chief—Packing. Keasbey & Mattison Co., Ambler, Pa.

Chieftain—Compressors. Tecumseh Products Co., Tecumseh, Mich.

Chill-Vactor—Steam jet compressors. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Chinook—Ferrous heating surface. Bayley Blower Co., Milwaukee, Wis.

Chinookfin—Non-ferrous heating surface. Bayley Blower Co., Milwaukee, Wis.

Chip Chaser—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Chromalox—Preheaters, unit heaters. Wiegand Co., Edwin L., Pittsburgh, Pa.

Chronoflo—Flow meters. Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.

Chronometer—Valves. Defender Automatic Regulator Co., St. Louis, Mo.

Chronotherm—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Circle T—Switches. Trumbull Electric Co., Plainville, Conn.

Circo—Louvers and Shutters. Circulators & Devices Mfg. Corp., New York, N. Y.

CirCOOLator—Fans, ventilators. Viking Air Conditioning Corp., Cleveland, O.

Clamp-A-Leak—Pipe repair clamps. Chelsea Metal Stamping Co., New York, N. Y.

Clarco—Unit heaters. Clarage Fan Co., Kalamazoo, Mich.

Clark-Sundh—Motor controls. Clark Controller Co., Cleveland, O.

Classic—Registers. Auer Register Co., Cleveland, O.

Cleanair—Aftercoolers. Bell & Gossett Co., Morton Grove, Ill.

Cle-Bar—Heaters. Cleghorn Co., Boston, Mass.

Climate Changer—Unit air conditioners, unit air coolers. Trane Co., La Crosse, Wis.

Climax—Unions. Devlin Mfg. Co., Inc., Thos., Burlington, N. J.

Cocheco—Belting. Williams & Son, I. B., Dover, N. H.

Code-Craft—Headers, heaters, preheaters, tanks. Zallea Brothers & Johnson, Wilmington, Del.

Coey—Cooling towers. Research Corp., New York, N. Y.

Cog-Belt—Transmission drives. Dayton Rubber Mfg. Co., Dayton, O.

Colalloy—Couplings, fittings, flanges, nipples, pipe, sheets, structural shapes, tubing, unions, valves. Colonial Alloys Co., Metals Div., Philadelphia, Pa.

Cold Stream—Unit air conditioners. Baker Ice Machine Co., Inc., Omaha, Nebr.

Colonial—Registers. Auer Register Co., Cleveland, O.

Columbia—Odor adsorbers. Carbide and Carbon Chemicals Corp., New York, N. Y.

Combustioneer—Stokers. Steel Products Engineering Co., Springfield, O.

Comet—Fans, unit heaters. New York Blower Co., Chicago, Ill.

Comfort-Air—Humidifiers. Comfort Products Corp., Harvey, Ill.

Comfortrol—Effective temperature control. Friez & Sons, Julien P., Baltimore, Md.

Comfostat—Thermostats. Johnson Service Co., Milwaukee, Wis.

Co-Min-Co—Insulating cement. United States Mineral Wool Co., Chicago, Ill.

Compact—Radiation. Kohler Co., Kohler, Wis.

Compak—Valves. Commonwealth Brass Corp., Detroit, Mich.

Compass—Belting. Goodyear Tire & Rubber Co., Akron, O.

Concavex—Bearings. Shafer Bearing Corp., Chicago, Ill.

Conco—Boiler cleaning compounds, water treatment. Continental Products Co., Euclid, O.

Condor—Belting, V belts, pipe. Manhattan Rubber Mfg. Div. of Raybestos Manhattan, Inc., Passaic, N. J.

Condo-Vac—Vacuum pumps. Chicago Pump Co., Chicago, Ill.

Coni-Vane—Ventilators. Allen Corp., Detroit, Mich.

Con-Tac-Tor—Switches. Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

Control-O-Gas—Valves. Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.

Convectofin—Radiation. Commodore Heaters Corp., New York, N. Y.

Convector—Humidifiers. Maid-O-Mist, Inc., Chicago, Ill.

Coolair—Fans. American Coolair Corp., Jacksonville, Fla.

Coolerair—Unit air conditioners. Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.

Coolite—Windows. Mississippi Glass Co., New York, N. Y.

Coolvent—Fans. Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.

Copaltite—Cement and compounds. National Engineering Products, Inc., Washington, D. C.

Copes—Governors, steam desuperheaters, valves. Northern Equipment Erie, Pa.

Cop-R-Loy—Steel sheets. Wheeling Corrugating Co., Wheeling, W. Va.

Cop-R-Loy—Sheets. Wheeling Steel Corp., Wheeling, W. Va.

Corkoustic—Insulation. Armstrong Cork Co., Lancaster, Pa.

Corto—Radiation. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Cottrell—Dust collectors. Research Corp., New York, N. Y.

Coxe—Boilers. Combustion Engineering Co., New York, N. Y.

Crescent—Burners. Caloroil Burner Corp., Hartford, Conn.

Crescent—Unions. Star Mfg. Co., Inc., Providence, R. I.

Cromaloy—Solder. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Crown—Cement and compounds. Colebrook & Sons, Inc., W. H., Syracuse, N. Y.

Crucibleweld—Electrodes. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Cub—Unions. Rhode Island Fittings Co., Hillsgrove, R. I.

Curtis—Regulators, traps, valves. Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.

Cycloidal—Air washers. Blower Application Co., Milwaukee, Wis.

Cyclops—Roller bearings. Roller Bearing Co. of America, Trenton, N. J.

Cyclotherm — Boilers. Ames Iron Works, Div. of Pierce Butler Radiator Corp., Oswego, N. Y.

Cyclotherm—Boilers. General Furnaces Corp., New York, N. Y.

DH—Ball bearings. Dodge Mfg. Corp., Mishawaka, Ind.

D & H — Evaporative condensers, cooling and heating surfaces, unit air conditioners. Drayer & Hanson, Inc., Los Angeles, Cal.

DV—Speed changers, v-belt drives. Dodge Mfg. Corp., Mishawaka, Ind.

Dart—Unions. Fairbanks Co., New York, N. Y.

Daytex—Cord. Dayton Rubber Mfg. Co., Dayton, O.

Dean—Cleaners. Pierce Co., Wm. B., The, Buffalo, N. Y.

Debecote—Protective coatings. Debevoise Co., The, Brooklyn, N. Y.

Defender—Heaters. Handley Brown Heater Co., Jackson, Mich.

Deflecto—Roof ventilators. Day Co., The, Minneapolis, Minn.

Deflect-O-Grille—Grilles. U. S. Air Conditioning Corp., Minneapolis, Minn.

Detroit—Traps. Nason Co., Detroit, Mich.

Detroit LoStoker—Stokers. Detroit Stoker Co., Detroit, Mich.

Detroit Unistoker — Stokers. Detroit Stoker Co., Detroit, Mich.

Dew-Aire — Air conditioning units. Standard Computing Scale Co., The, Air Conditioning & Refrigeration Div., Detroit, Mich.

Dexter—Air separators. Leavitt Machine Co., Orange, Mass.

Dexter-Goebel — Systems, regulators. National Brass Co., Grand Rapids, Mich.

Dezert Kooler—Units. Utility Fan Corp., Los Angeles, Cal.

Diamond Fibre—Gaskets. Continental Diamond Fibre Co., Newark, Del.

Diamond H — Switches, thermostats. Hart Mfg. Co., Hartford, Conn.

Dickbelt—Belting. Dick Co., Inc., R. & J., Passaic, N. J.

Dickrope—V belts. Dick Co., Inc., R. & J., Passaic, N. J.

Difr-enshal-Vacm — Heating systems. Dunham Co., C. A., Chicago, Ill.

Dilecto—Plastic pipe, tubing, fittings and valves. Continental Diamond Fibre Co., Newark, Del.

Direct—Pipe fittings and flanges, separators, strainers. Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.

Directherm—Direct fired heaters. Airtherm Mfg. Co., St. Louis, Mo.

Discfin—Cooling surface. General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.

Disc-Loc — Registers. Knowles Mushroom Ventilator Co., Montclair, N. J.

Distributor — Radiation. Kehm Corp., The, Chicago, Ill.

Divide—Separators. Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.

Dominion—Gaskets, packing. Darcoid Co., Inc., New York, N. Y.

Dorex—Odor adsorbers. Connor Engineering Corp., W. B., Dorex Div., New York, N. Y.

Dorex Kno-Draft—Air diffusers. Connor Engineering Corp., W. B., Dorex Div., New York, N. Y.

Double Check — Boiler compounds. Hampton-Cross Co., The, Louisville, Ky.

Double Diamond — Hygrometers, recorders, psychrometers. H-B Instrument Co., Philadelphia, Pa.

Double-Seal—Copper tube fittings. Hays Mfg. Co., Erie, Pa.

Downblast—Unit heaters. Sturtevant Co., B. F., Boston, Mass.

Draftite—Cement, Keasbey & Mattison Co., Ambler, Pa.

Draftrite — Gages. Bacharach Industrial Instrument Co., Pittsburgh, Pa.

Drainator — Traps. Coe Mfg. Co., Painesville, O.

Dry-Ice — Refrigerants. Pure Carbonic, Inc., New York, N. Y.

Dry-paC—Insulation. Ric-wiL Co., Cleveland, O.

Dualarc — Arc welders. Electric Arc, Inc., Newark, N. J.

Dual-Clone—Dust collectors. Day Co., The, Minneapolis, Minn.

Dualsteel—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Dual-System—Hot water heating systems. General Blower Co., Inc., Philadelphia, Pa.

Dubbiseal—Insulation. Masonite Corp., Chicago, Ill.

Duco—Enamels and lacquers. du Pont de Nemours & Co. (Inc.), E. I., Fabrics & Finishes Dept., Wilmington, Del.

Dulux—Enamels and lacquers. du Pont de Nemours & Co. (Inc.), E. I., Fabrics & Finishes Dept., Wilmington, Del.

Dunco—Relays, switches, thermostats. Dunn Inc., Struthers, Philadelphia, Pa.

Duoflo—Pipe line strainers. Sheffler-Gross Co., Philadelphia, Pa.

Duo-Stat — Heating systems, thermostats. Johnson Service Co., Milwaukee, Wis.

Duotrol—Regulators. Automatic Control Co., St. Paul, Minn.

Duplex—Insulation. Keasbey & Mattison Co., Ambler, Pa.

Duplex—Pipe cutting machines. Bignall & Keeler Machine Works, Edwardsville, Ill.

Duplex—Pipe line strainers. Maid-O-Mist, Inc., Chicago, Ill.

Duplex—Tubing. Bridgeport Brass Co., Bridgeport, Conn.

DuraBilt—Registers. Auer Register Co., Cleveland, O.

Duradiant—Gas burners. Selas Co., The, Philadelphia, Pa.

Dura-Flex—Registers. Auer Register Co., Cleveland, O.

Dura-Fram—Valves. Detroit Lubricator Co., Detroit, Mich.

Dura-Line—Registers. Auer Register Co., Cleveland, O.

Durant—Pipe. Ehret Magnesia Mfg. Co., Valley Forge, Pa.

DuraSpeed—Sprinkler heads. Grinnell Co., Inc., Providence, R. I.

Durex—Bearings. General Motors Corp., Moraine Products Div., Dayton, O.

Duroline — Pipe. National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.

Dust-Stop—Air filters. Owens-Corning Fiberglas Corp., Toledo, O.

Dustube—Dust collectors. American Foundry Equipment Co., Mishawaka, Ind.

Duxbak—Leather belting and packing. Schieren Co., Chas. A., New York, N. Y.

Dux-Sulation—Insulation. Wilson, Inc., Grant, Chicago, Ill.

Dyna-Flame—Burners. Air Devices, Inc., New York, N. Y.

E-C—V belts. Goodyear Tire & Rubber Co., Akron, O.

EC & M—Motor controls. Electric Controller & Mfg. Co., Cleveland, O.

Eafco—Fittings. Eastern Foundry Co., Boyertown, Pa.

Eastwood—Boilers, radiation. Pierce Butler Radiator Corp., Syracuse, N. Y.

Easyclean—Strainers. Wright-Austin Co., Detroit, Mich.

Easy-Flo—Solder. Handy & Harman, New York, N. Y.

Easyweld—Electrodes. Universal Power Corp., Cleveland, O.

Eclipse — Compressors. Frick Co., Waynesboro, Pa.

Eclipse—Governors, regulators, traps, valves. Illinois Engineering Co., Chicago, Ill.

Economy—Boilers, heaters. International Heater Co., Utica, N. Y.

Economy—Heating systems. Maid-O-Mist, Inc., Chicago, Ill.

Economy—Regulators. Dockson Corp., Detroit, Mich.

Economy—Unit ventilators. Arex Co., Chicago, Ill.

Edgeseal—Air filters. Wilson & Co., Chicago, Ill.

Effico—Louvers and shutters. Hirschman Co., W. F., Buffalo, N. Y.

"88"—Pipe covering. Eagle-Picher Lead Co., Cincinnati, O.

Electo-Wind—Ventilators. Allen Corp., Detroit, Mich.

Electric Filter Watchman—Gages. Herbusch Corp., The, St. Louis, Mo.

Electrifugal—Centrifugal pumps. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Electro-Matic—Air cleaners. American Air Filter Co., Inc., Louisville, Ky.

Electromode—Electric heaters. Electric Air Heater Co., Div., American Foundry Equipment Co., Mishawaka, Ind.

Electro-Sheet—Sheets. American Brass Co., Waterbury, Conn.

Electrozone—Ozone apparatus. Automatic Pump & Softener Corp., Rockford, Ill.

Electrunite—Stainless steel tubing. Steel and Tubes, Div. of Republic Steel Corp., Cleveland, O.

Elgin — Louvers and shutters. Elgo Shutter & Mfg. Co., Detroit, Mich.

Elite—Registers. Auer Register Co., Cleveland, O.

Elturn—Duct turning vanes. Barber-Colman Co., Rockford, Ill.

Embee—Cement and compounds. Montgomery Bros., San Francisco, Cal.

Emco—Regulatorc. Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Emergency—Steam traps. Wright-Austin Co., Detroit, Mich.

Enco—Burners, regulators. Engineer Co., New York, N. Y.

Enduro—Packing. Keasbey & Mattison Co., Ambler, Pa.

Enduro—Pipe, sheets, tubing. Steel and Tubes, Div. of Republic Steel Corp., Cleveland, O.

Enduro—Unions. Jefferson Union Co., Inc., Lockport, N. Y.

Entrained Combustion—Gas burners. Mettler Co., Lee B., Los Angeles, Cal.

Equatherm—Zone control thermostat. Tallmadge & Co., Webster, East Orange, N. J.

Equiflo—Valves. Grinnell Co., Inc., Providence, R. I.

Eroduct — Insulation. Ehret Magnesia Mfg. Co., Valley Forge, Pa.

Erwin—Dampers. Elgo Shutter & Mfg. Co., Detroit, Mich.

Esso—Heaters. Gilbert & Barker Mfg. Co., Springfield, Mass.

Eureka—Valves. Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.

Evactor—Pumps. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Evco—Valves. Electric Valve Mfg. Co., Inc., New York, N. Y.

Evenaction—Valves. Taylor Instrument Companies, Rochester, N. Y.

Evenaire—Insulation. Plastergon Wall Board Co., Buffalo, N. Y.

Everlast—Exhaust heads. Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.

Evrtyte—Valves. Strong, Carlisle & Hammond Co., The, Cleveland, O.

Excel — Unions. Jefferson Union Co., Inc., Lockport, N. Y.

Excelso — Water heaters. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Exhaustair—Fans. New York Blower Co., Chicago, Ill.

Exidust—Dust collectors. Allen Billmyre Corp., South Norwalk, Conn.

Extra Dry Esotoo—Liquid sulphur dioxide. Virginia Smelting Co., West Norfolk, Va.

Eye-Hye—Gages. Reliance Gauge Column Co., Cleveland, O.

E-Z-ON—Damper quadrants. Gerett Corp., M. A., Milwaukee, Wis.

F & E—Stokers. Flynn & Emrich Co., Baltimore, Md.

Fabrikated—Grilles, registers. Independent Register Co., Cleveland, O.

Falcon—Heaters, preheaters. Swoboda, Inc., H. O., New Brighton, Pa.

Fan-Air—Gas burners. Mettler Co., Lee B., Los Angeles, Cal.

Fanmix—Burners. Coppus Engineering Corp., Worcester, Mass.

Fantom—Radiation. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Farragut—Packing. Darcoid Co., Inc., New York, N. Y.

Fast's—Couplings. Koppers Co., Bartlett Hayward Div., Baltimore, Md.

Favorite—Ratchet wrenches. Greene, Tweed & Co., New York, N. Y.

Featherfin—Heating and cooling surface. Wing Mfg. Co., L. J., New York, N. Y.

Featherweight—Thermostats. Magnet Switch Co., Chicago, Ill.

Featherweight—Unit heaters. Wing Mfg. Co., L. J., New York, N. Y.

Fel-Pro—Gaskets, packing. Felt Products Mfg. Co., Chicago, Ill.

Fenestra — Heat insulating windows. Detroit Steel Products Co., Detroit, Mich.

Fenn's Rotary—Ventilators. Waverly Heating Supply Co., Boston, Mass.

Fenox — Compounds. Halowax Corp., New York, N. Y.

Fero — Radiation. Burnham Boiler Corp., Irvington, N. J.

Ferrenewo—Valves. Lunkenheimer Co., Cincinnati, O.

Ferroclad—Insulation. Truscon Steel Co., Youngstown, O.

Ferro-Therm — Insulation. American Flange & Mfg. Co., Inc., New York, N. Y.

Ferroweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Fiberglas—Insulation. Owens-Corning Fiberglas Corp., Toledo, O.

Fiberlite—Insulation. Insulite Co., Minneapolis, Minn.

Fields—Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Filmflo—Deaerators. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Filteraire—Window ventilator and filter units. Davies Air Filter Corp., New York, N. Y.

Fin-Flex—Registers. Auer Register Co., Cleveland, O.

Findlay—Stokers. Bluffton Mfg. Co., The, Findlay, O.

Fin-Line—Registers. Auer Register Co., Cleveland, O.

Fire Tender—Stokers. Holcomb & Hoke Mfg.Co., Indianapolis, Ind.

Firefoil—Insulating panel. Carey Mfg. Co., Philip, Cincinnati, O.

Fireite—Furnace cement. Johns-Manville, New York, N. Y.

Five Star—Boilers. Smith Co., Inc., H. B., The, Westfield, Mass.

Flatjet—Spray nozzles. Spraying Systems Co., Chicago, Ill.

Flexarc—Arc welders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Flexair—Grilles, registers. Tuttle & Bailey, Inc., New Britain, Conn.

Flexcord—Drives. Gates Rubber Co., Denver, Colo.

Flexeal—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Flexiwound—Gaskets. Azor Corp., Newark, N. J.

Flexodisc — Expansion joints. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Flextan—Packing. Chicago Belting Co., Chicago, Ill.

Floatrol—Switches. Automatic Control Co., St. Paul, Minn.

Flo-Klean—Filters, strainers. Cuno Engineering Corp., Meriden, Conn.

Flotrol — Valves. Monmouth Products Co., Cleveland, O.

Flotrol-Microfeed — Humidifiers. Monmouth Products Co., Cleveland, O.

Flo-watch — Flow meters. Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.

Flualyzer—Analyzers. Engelhard, Inc., Chas., Newark, N. J.

Flush-Kleen—Sewage ejectors. Chicago Pump Co., Chicago, Ill.

Forcedraft—Unit air coolers. Fedders Mfg. Co., Inc., Buffalo, N. Y.

Force-Flo—Circulators, heaters, regulators, systems. Kehm Corp., The, Chicago, Ill.

Fordair—Compressors. Schramm, Inc., West Chester, Pa.

Forest Fleece—Insulation. Doheny Co., John J., Belmont, Mass.

Fosco—Ventilators. Schoedinger, F. O., Columbus, O.

Francke—Flexible couplings. Waldron Corp., John, New Brunswick, N. J.

Freeflo—Grilles. Trane Co., La Crosse, Wis.

Freon—Refrigerant. Kinetic Chemicals, Inc., Wilmington, Del.

Fretz—Nipples. Devlin Mfg. Co., Inc., Thos., Burlington, N. J.

Frevent—Valves. Russell & Co., W. A., Bridgeport, Conn.

Friction Fighter—Bearings. Link-Belt Co., Indianapolis, Ind.

Frigid—High pressure blowers, propeller fan blades and fans. Circulators & Devices Mfg. Corp., New York, N. Y.

Frigistat — Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Frigitower—Cooling towers. Schubert-Christy Corp., St. Louis, Mo.

Frostaire — Air conditioning units. Palmer Mfg. Corp., Phoenix, Ariz.

Fuel Saver — Boilers. International Boiler Wks. Co., East Stroudsburg, Pa.

Fulljet—Spray nozzles. Spraying Systems Co., Chicago, Ill.

Fulscope — Recorders, recorder - controllers, regulators. Taylor Instrument Companies, Rochester, N. Y.

Fyr-Feeder—Stokers. American Coal Burner Co., Chicago, Ill.

Fyrite — Analyzers. Bacharach Industrial Instrument Co., Pittsburgh, Pa.

G.B.C.—Circulators. General Blower Co., Inc., Philadelphia, Pa.

G-E—Condensers. General Electric Co., Air Conditioning & Commercial Refrigeration Dept., Bloomfield, N. J.

G-M—Grilles, louvers and shutters, registers. Gillian Mfg. Co., Detroit, Mich.

G-R—Unit coolers and air conditioners. General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.

GTD—Pipe vises and wrenches. Greenfield Tap & Die Corp., Greenfield, Mass.

Gale—Ducts, grilles, registers. Char-Gale Mfg. Co., Minneapolis, Minn.

Gast—Filters, separators. Johnson Corp., Three Rivers, Mich.

Gas-Vac — Furnaces, heaters. Vacuum Gas Appliances Div., The Union Fork & Hoe Co., Rome, N. Y.

Geddes—Radiation. Fowler & Wolfe Radiator Co., Norristown, Pa.

Gemaco—Compressors. General Machinery Co., Spokane, Wash.

Gemware — Hygrometers, psychrometers, thermometers. G. M. Mfg. Co., New York, N. Y.

Genasco—Insulation, pipe joint cement and compounds. Barber Asphalt Corp., Barber, N. J.

Genspring—Pipe supports. Grinnell Co., Inc., Providence, R. I.

Genuine Detroit—Gages, humidistats, operators, switches, thermostats, valves. Detroit Lubricator Co., Detroit, Mich.

Genuine Stillson—Wrenches. Walworth Co., New York, N. Y.

Germicidal—Lamps. General Electric Co., Lamp Dept., Cleveland, O.

Geyser—Water heaters. Thatcher Furnace Co., Newark, N. J.

Gilbarco—Heaters, compressors, regulators. Gilbert & Barker Mfg. Co., Springfield, Mass.

Gilsonite—Protective coatings. Ohmlac Paint & Refining Co., Chicago, Ill.

Gilt Edge—Belting. Rhoads & Sons, J. E., Philadelphia, Pa.

Gimco — Insulation. National Gypsum Co., Buffalo, N. Y.

Gland-Pakt—Expansion joints. Yarnall-Waring Co., Philadelphia, Pa.

Globack—Pipe flanges. Midwest Piping & Supply Co., Inc., St. Louis, Mo.

Globe—Ventilators. Osborn Co., The J. M. & L. A., Cleveland, O.

Gloco Red Band—Water heaters. Glore Sales Corp., Evins F., New York, N. Y.

Glowan—Gas burners. Martin, J. O. & C. U., San Francisco, Cal.

Goetzerit—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Gohi — Sheets. Newport Rolling Mill Co., Newport, Ky.

Gold Bond—Insulation. National Gypsum Co., Buffalo, N. Y.

Gold-Seal—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

Golden Rod—Blower wheels, fans, heaters, unit air conditioners. Jaden Mfg. Co., Inc., F., Hastings, Neb.

Goodyearite—Packing. Goodyear Tire & Rubber Co., Akron, O.

Gothic—Radiation. Thatcher Furnace Co., Newark, N. J.

Grad-U-Motor—Damper operators. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Gradustat — Regulators, thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Gradutrol—Diaphragm valves. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Graylite—Insulation. Insulite Co., Minneapolis, Minn.

Greastop—Air filters. Air-Maze Corp., Cleveland, O.

Grid—Unit heaters. Murray Mfg. Co., D. J., Wausau, Wis.

Grillometer—Direct reading air velocity meters. Detroit Air Meter Co., Detroit, Mich.

Guardian—Gaskets. Garlock Packing Co., Palmyra, N. Y.

Gulf Stream—Water heaters. Marion Machine Foundry & Supply Co., Marion, Ind.

Gun-Pakt—Expansion joints. Yarnall-Waring Co., Philadelphia, Pa.

Guthfan—Fans. Guth Co., Edwin F., St. Louis, Mo.

H & C—Grilles, registers. Hart & Cooley Mfg. Co., Holland, Mich.

H-O-H—Compounds, water treatment. Haering & Co., Inc., D. W., Chicago, Ill.

H-T—Smoke alarms. Au-Temp-Co Corp., New York, N. Y.

Hairbestos—Insulation. Wilson & Co., Chicago, Ill.

Haircraft—Insulation. Wilson & Co., Chicago, Ill.

Hammerkraft—Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Hammermill—Belting. Goodyear Tire & Rubber Co., Akron, O.

Hammer-On—Damper quadrants. Air Control Products, Inc., Muskegon, Mich.

Hammer-Set—Bolts. Rawlplug Co., Inc., The, New York, N. Y.

Handy—Benders. Holsclaw Bros., Inc., Evansville, Ind.

Handy Andy—Vise stands. Western Wire Products Co., St. Louis, Mo.

Hardweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Hartman—Air conditioning units. Norwood Filtration Co., The, Florence, Mass.

Hartmann—Heaters. Montgomery Bros., San Francisco, Cal.

Haveg—Tanks. Continental Diamond Fibre Co., Newark, Del.

Hazleton—Pumps, strainers, valves. Barrett, Haentjens & Co., Hazleton, Pa.

Health-Air—Ventilator and filter units. Ad-Lee Co., Inc., Chicago, Ill.

Health-Aire—Fans, heaters, unit coolers, ventilators. Johnson Fan & Blower Co., Chicago, Ill.

Heart-Oak—Belting. Graton & Knight Co., Worcester, Mass.

Heat Breaker—Fans. Esko Mfg. Corp., Houston, Tex.

Heath—Manometers. Detroit Air Meter Co., Detroit, Mich.

Heatomat—Heaters. Richmond Radiator Co., Gas Products Div., Uniontown, Pa.

Heat-Rite — Registers. Auer Register Co., Cleveland, O.

Heggie-Simplex—Boilers. Lookout Boiler & Mfg. Co., Chattanooga, Tenn.

Helical—Tubing. Rome-Turney Radiator Co., Rome, N. Y.

Hensel—Welders. Maple Valley Mfg. Co., Mapleton, Ia.

Herculoy—Welding rod. Revere Copper and Brass, Incorporated, New York, N. Y.

Hevikoat—Electrodes. Universal Power Corp., Cleveland, O.

Hiflo—Convection type radiation. Modine Mfg. Co., Racine, Wis.

Highflex—Belting. Goodrich Co., B. F., Akron, O.

High-Temp—Packing. Keasbey & Mattison Co., Ambler, Pa.

Hijet—Unit heaters. Nelson Corp., Herman, Moline, Ill.

Hilger—Chillers, refrigerating compressors, unit coolers, unit air conditioners, valves. XL Refrigerating Co., Inc., Chicago, Ill.

Hi-Lo — Alarms. Yarnall-Waring Co., Philadelphia, Pa.

Hi-Lo—Pumps. Yeomans Bros. Co., Chicago, Ill.

Hi-Spra — Spray nozzles. Schubert-Christy Corp., St. Louis, Mo.

Hitchings—Boilers. Burnham Boiler Corp., Irvington, N. Y.

Hi-Temp—Insulation. Carey Mfg. Co., Philip, Lockland, Cincinnati, O.

Hi-Test—Pipe. Walworth Co., New York, N. Y.

Holby—Valves. Boiler Room Equipment, Inc., New York, N. Y.

Holdfast—Solder. American Brass Co., Waterbury, Conn.

Holt—Strainers, tube cleaners. Rosedale Foundry & Machine Co., Pittsburgh, Pa.

Holtite—Clamps. Yarnall-Waring Co., Philadelphia, Pa.

Horneblende — Caulking compounds. North American Fibre Products Co., The, Cleveland, O.

Horton—Tanks. Chicago Bridge & Iron Co., Chicago, Ill.

Hot Shot—Pumps. Yeomans Bros. Co., Chicago, Ill.

Hot Spot—Spot welders. Acme Electric Welder Co., Los Angeles, Cal.

Hovalco—Valves. Homestead Valve Mfg. Co., Coraopolis, Pa.

Huber—Stokers. Flynn & Emrich Co., Baltimore, Md.

Humidair—Humidifiers. Skilbeck Mfg. Co., Kenosha, Wis.

Humid-Heet—Radiators. Utica Radiator Corp., Utica, N. Y.

Humidigrad — Humidifiers. Monmouth Products Co., Cleveland, O.

Humidigraph — Humidity recorders. Bristol Co., Waterbury, Conn.

Humidiguide—Hygrometers. Taylor Instrument Companies, Rochester, N. Y.

Humidome—Humidifiers and unit air conditioners. Alter Co., Harry, Chicago, Ill.

Humidostat—Humidistats. Johnson Service Co., Milwaukee, Wis.

Humi-Temps—Unit air coolers. Larkin Coils, Inc., Atlanta, Ga.

Humphrey—Unit heaters. General Gas Light Co., Kalamazoo, Mich.

Hycarb—Electrodes. Universal Power Corp., Cleveland, O.

Hydra—Valves. Albright Equipment Co., Pittsburgh, Pa.

Hydramotor—Valves. General Controls Co., Glendale, Cal.

HydraStoker—Stokers. Detroit Stoker Co., Detroit, Mich.

Hydro—Recorders. Bacharach Industrial Instrument Co., Pittsburgh, Pa.

Hydro—Packing. Keasbey & Mattison Co., Ambler, Pa.

Hydro-Clone — Collectors, condensers. Faraday Engineering Co., Boston, Mass.

Hydron—Bellows, traps. Clifford Mfg. Co., Boston, Mass.

Hydrovac—Pumps. Ames Hydrovac Corp., Brooklyn, N. Y.

Hydro-Whirl—Dust collectors. Industrial Sheet Metal Works, Inc., Detroit, Mich.

Hy-Duty—Bearings, blower wheels, fans. Schwitzer-Cummins Co., Indianapolis, Ind.

Hylo—Heating systems. Webster & Co., Warren, Camden, N. J.

Hy-Temp—Cement, insulation. Keasbey & Mattison Co., Ambler, Pa.

Hy-Test—Water heaters. Smith Co., Inc., H. B., The, Westfield, Mass.

Hytherstat—Combination humidity and temperature control. Friez & Sons, Julien P., Baltimore, Md.

Hytor—Pumps. Nash Engineering Co., South Norwalk, Conn.

I-R—Ingersoll-Rand, New York, N. Y.

Ice Engine—Gas and diesel engines. Waukesha Motor Co., Waukesha, Wis.

Ice-O-Matic — Refrigerating compressors. Williams Oil-O-Matic Heating Corp., Bloomington, Ill.

Ideal—Blowers. Perfection Grate & Stoker Co., Springfield, Mass.

Ideal—Boilers, water heaters, valves. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Ideal — Ventilators. Tuttle & Bailey, Inc., New Britain, Conn.

Ideal—Traps. Nason Co., Detroit, Mich.

Impact—Spray nozzles. Cooling Tower Co., Inc., The, Div. of the Fluor Corp., Ltd., New York, N. Y.

Imperial—Boilers. National Radiator Co., The, Johnstown, Pa.

IngAclad—Stainless clad sheets. Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago, Ill.

In-Hib-Co—Protective coatings. Haering Co., Inc., D. W., Chicago, Ill.

Ins-lite—Insulation. Insulite Co., Minneapolis, Minn.

Instant—Heaters, preheaters. Johnson Corp., Three Rivers, Mich.

Insulfil—Insulation. Refractory & Insulation Corp., New York, N. Y.

Insulseal—Caulking compounds. Eagle-Picher Lead Co., Cincinnati, O.

Insulwool—Insulation. General Insulating Products Co., Brooklyn, N. Y.

Insutube—Insulation. Union Asbestos & Rubber Co., Cicero, Ill.

Involute—Spray nozzles. Yarnall-Waring Co., Philadelphia, Pa.

Ionaire—Ionization apparatus. Electroaire Corp., Chicago, Ill.

Ironset—Furnace cement. Fireline Stove & Furnace Lining Co., Chicago, Ill.

Ironton—Burners. Continental Stove Corp., Ironton, O.

J F S—Speed changers and reducers. Stephens-Adamson Mfg. Co., Aurora, Ill.

J-M Ball—Foats, traps. Cryer Trap & Valve Co., Inc., New York, N. Y.

J. M. C.—Burners. Johnson Mfg. Co., Waterloo, Ia.

Janitrol—Burners, heaters, unit air conditioners. Surface Combustion Corp., Toledo, O.

Jarco—Unions. Jarecki Mfg. Co., Erie, Pa.

Jennings—Pumps, ejectors. Nash Engineering Co., South Norwalk, Conn.

Jewel—Packing. Keasbey & Mattison Co., Ambler, Pa.

John Crane—Cement and compounds. Crane Packing Co., Chicago, Ill.

Jointite — Insulation. Mundet Cork Corp., Brooklyn, N. Y.

Jones—Stokers. Riley Stoker Corp., Worcester, Mass.

Julian d'Este—Floats, governors, strainers, thermostats, valves. Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.

Jusrite—Ducts and duct fittings. Corbman Bros., Inc., Philadelphia, Pa.

K—Fittings. Kuhns Brothers Co., Dayton, O.

K-S-V—Ventilators. Kernchen Co., Chicago, Ill.

Kable Kord—Belting. Gilmer Co., L. H., Philadelphia, Pa.

Kane—Boilers, gas burners. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Karbate—Carbon pipe. National Carbon Co., Carbon Sales Div., Cleveland, O.

Kathabar — Dehumidifiers, humidifiers, unit air conditioners. Surface Combustion Corp., Toledo, O.

Kearsarge—Gaskets, packing. Johns-Manville, New York, N. Y.

Kelly—Valves. National Metal Products Corp., Chicago, Ill.

Kentucky—Sheets. Newport Rolling Mill Co., Newport, Ky.

Key-Tite—Cement and compounds. Key Co., East St. Louis, Ill.

Kidskin—Packing. Darcoid Co., Inc., New York, N. Y.

Kimsul — Insulation. Kimberly-Clark Corp., Neenah, Wis.

King-clip—Valves. Lunkenheimer Co., Cincinnati, O.

King-Gage—Gages. King Engineering Corp., Ann Arbor, Mich.

Kitchenaire—Propeller fans. Allen Corp., Detroit, Mich.

Kleen Tube—Heaters. Vapor Car Heating Co., Inc., Chicago, Ill.

Kleenflo — Unit air filters. Air-Maze Corp., Cleveland, O.

Klingtite—Belting. Goodyear Tire & Rubber Co., Akron, O.

Klixon—Temperature controls. Spencer Thermostat Co., Attleboro, Mass.

Klondike—Arc welders. Fern, Ralph, Scranton, Pa.

K-Master—Strainers, traps. Kaye & Macdonald, Inc., West Orange, N. J.

Knight-Ware — Pipe. Knight, Maurice A., Akron, O.

Kon-Nec-Tor—Mercury switches. General Electric Co., Lamp Dept., Cleveland, O.

Kool-Shade — Solar heat resisting screens. Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago, Ill.

Kooler-Aire—Commercial air conditioners. U. S. Air Conditioning Corp., Minneapolis, Minn.

Kopp-Sure-Travel—Joints. Kopperman & Sons, Joseph, Philadelphia, Pa.

Krupp—Valves. Shank Co., Cyrus, Chicago, Ill.

L. A.—Motors. Louis Allis Co., Milwaukee, Wis.

L&N—Regulators. Leeds & Northrup Co., Philadelphia, Pa.

L-R—Couplings. Lovejoy Flexible Couplings Co., Chicago, Ill.

L. R. D.—Valves. Grinnell Co., Inc., Providence, R. I.

Laddi—Heaters. Johnson Co., S. T. Oakland, Cal.

Lamino—Insulation. Keasbey & Mattison Co., Ambler, Pa.

Lavigne—Valves. Commonwealth Brass Corp., Detroit, Mich.

Lawson—Wrenches. USHCO Mfg. Co., Inc., Buffalo, N. Y.

Leader—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Lectrodryer—Dehumidifiers. Pittsburgh Lectrodryer Corp., Pittsburgh, Pa.

Lectro Shear—Shears. Black & Decker Mfg. Co., Towson, Md.

Ledaloyl—Sleeve bearings. Johnson Bronze Co., New Castle, Pa.

Levelometer—Gages, recorders. Liquidometer Corp., Long Island City, N. Y.

Liberty—Packing. Johns-Manville, New York, N. Y.

Little Blacksmith — Punches, shears. Kidder Mfg. Co., Inc., J. F., Burlington, Vt.

Lima—Stokers. Carnes, Inc., John R., Lima, O.

Limit-Load—Centrifugal fans. Buffalo Forge Co., Buffalo, N. Y.

Limitorque—Valves. Philadelphia Gear Works, Inc., Philadelphia, Pa.

Limpet—Insulation. Keasbey & Mattison Co., Ambler, Pa.

Linabestos—Insulation. Celotex Corp., The, Chicago, Ill.

Linc-Weld—Motors. Lincoln Electric Co., Cleveland, O.

Lindsay Structure—Cabinet construction for air conditioning equipment. Dry-Zero Corp., Chicago, Ill.

Lipman—Compressors, cooling surface. General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.

Liquivator—Pumps. Morehead Mfg. Co., Detroit, Mich.

Little Giant—Pipe extractors, vises, stocks and dies. Greenfield Tap & Die Corp., Greenfield, Mass.

Little Giant—Unit heaters. Nesbitt, Inc., John J., Philadelphia, Pa.

Little Giant—Radiation. Pierce Butler Radiator Corp., Syracuse, N. Y.

Little Giant—Switches, Tork Clock Co., Inc., Mt. Vernon, N. Y.

Lo-Blast—Burners. National Machine Wks., Chicago, Ill.

Locarb—Electrodes. Universal Power Corp., Cleveland, O.

Lockaire—Insulation. Plastergon Wall Board Co., Buffalo, N. Y.

Logan—Radiation. Logansport Radiator Equipment Co., Logansport, Ind.

Lok-Joint — Insulation. Insulite Co., Minneapolis, Minn.

Lolag—Heaters. American Instrument Co., Silver Spring, Md.

Lo-Maintenance—Motors. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Longrip—Pipe extractors. Ridge Tool Co., Elyria, O.

Lord Burnham—Boilers. Burnham Boiler Corp., Irvington, N. Y.

Lowcost—Boilers. Murray Iron Wks., Co., Burlington, Ia.

Lubricore—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Lul—Unit coolers. Merchant & Evans Co., Philadelphia, Pa.

Luminarc—Electrodes. Universal Power Corp., Cleveland, O.

Lyonore—Sheets. Lyon, Conklin & Co., Inc., Baltimore, Md.

M. & E. — Refrigerating compressors. Merchant & Evans Co., Philadelphia, Pa.

MGC — Compressors. Hobart Bros., Troy, O.

M & M — Cut-offs, feeders, fittings, floats, governors, humidifiers, operators, pumps, regulators, switches, tubing, valves. McDonnell & Miller, Chicago, Ill.

M & S—Gaskets, insulation. Mitchell & Smith, Inc., Detroit, Mich.

MIF — Couplings, fittings. Malleable Iron Fittings Co., Branford, Conn.

MJL—Gages, manometers, meters, recorders. Morey & Jones, Ltd., Los Angeles, Cal.

MKO—Boiler feeders, pumps. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

M-R-C—Ball bearings. Marlin-Rockwell Corp., Jamestown, N. Y.

M/W and A/C Airmat — Air filters. American Air Filter Co., Inc., Louisville, Ky.

Macheta—Fans, fan blades. Aerovent Fan Co., Piqua, O.

Magic-Weather — Air washers, fans. Ballantyne Co., Omaha, Nebr.

Majestic — Boilers. Ames Iron Wks., Div. of Pierce Butler Radiator Corp., Oswego, N. Y.

Manganweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Mark Time—Time switches. Rhodes, Inc., M. H., Hartford, Conn.

Martell—Packing. France Packing Co., Tacony, Philadelphia, Pa.

Marvelaire—Furnaces. Essick Mfg. Co., Los Angeles, Cal.

Mascote—Insulation. Munn and Steele, Inc., Newark, N. J.

Massachusetts — Fans, unit heaters, blower wheels, air washers. Bishop & Babcock Mfg. Co., Cleveland, O.

Master—Stokers. Muncie Gear Wks., Inc., Muncie, Ind.

Master—Thermostats, regulators, switches. White Mfg. Co., St. Paul, Minn.

Master—Unions. Jefferson Union Co., Inc., Lockport, N. Y.

Master Kraft—Oil burners, unit heaters and air conditioners. Harvey-Whipple, Inc., Springfield, Mass.

McDaniel—Floats, traps. Watson & McDaniel Co., Philadelphia, Pa.

McKee—Blowers, boilers, burners, feeders, pumps, regulators, tanks, valves. Eclipse Fuel Engineering Co., Rockford, Ill.

McKeesport — Radiation. Columbia Radiator Co., McKeesport, Pa.

McKnight—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Measurrench — Wrenches. Williams & Co., J. H., New York, N. Y.

Mechanovent—Ventilators. New York Blower Co., Chicago, Ill.

Meco—Regulators, torches, valves, welding rod. Modern Engineering Co., St. Louis, Mo.

Mellobiu—Gas burners. Beck Engineering Combustion Kompany, St. Louis, Mo.

Mel-Rock—Humidifiers, units, ventilators, washers. Mellish & Murray Co., Chicago, Ill.

Menlo—Water heaters. Smith Co., Inc., H. B., The, Westfield, Mass.

Merkustat — Regulators, switches. Marsh Corp., Jas. P., Chicago, Ill.

Merrill Process — Heating systems. Parks-Cramer Co., Fitchburg, Mass.

Metal-Master—Shears. Wiss & Sons Co., J., Newark, N. J.

Metermax — Combustion control systems. Leeds & Northrup Co., Philadelphia, Pa.

Metric—Meters. American Meter Co., Inc., New York, N. Y.

Metrotherm — Thermostats. General Controls Co., Glendale, Cal.

Micarta—Bearings. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Micro—Low water cut-offs. Maid-O-Mist, Inc., Chicago, Ill.

Micromax — Recorders, recorder-controllers, thermometers. Leeds & Northrup Co., Philadelphia, Pa.

Microstat—Thermostats. Friez & Sons, Julien P., Baltimore, Md.

Microtherm—Thermostats. Barber-Colman Co., Rockford, Ill.

Micro-Weld—Spot welders. Micro Products Co., Chicago, Ill.

Midget — Radiation. Utica Radiator Corp., Utica, N. Y.

Mills—Boilers. Smith Co., Inc., H. B., The, Westfield, Mass.

Milvaco—Air eliminators, floats, heating systems, radiator orifices, strainers, traps, valves. Milwaukee Valve Co., Milwaukee, Wis.

Milwaukee—Heaters. Blower Application Co., Milwaukee, Wis.

Milwaukee—Stokers. Automatic Stoker Corp., Milwaukee, Wis.

Mircle Air—Window ventilator units. Ad-Lee Co., Inc., Chicago, Ill.

Mir-O-Meter—Combustion control systems. Bowser & Co., Inc., S. F., Fort Wayne, Ind.

Mirro-Matic—Heaters. Handley Brown Heater Co., Jackson, Mich.

Mirro-Shell—Heaters. Handley Brown Heater Co., Jackson, Mich.

MKayO — Boilers. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Mobilaire—Unit air coolers. Westinghouse Electric & Mfg. Co., Springfield, Mass.

Mobilene — Gaskets. Johns-Manville, New York, N. Y.

Moderator—Heating system. Warren Webster Co., Camden, N. J.

ModernAire—Fans, unit air conditioners. Dallas Engineering Co., Inc., Dallas, Tex.

Modustat — Valves. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Modutrol—Heating systems. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Modutron — Regulators. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Mogul—Packing. Johns-Manville, New York, N. Y.

Mogul—Boiler cleaning compounds and water treatment. North American Fibre Products Co., The, Cleveland, O.

Mohawk—Pipe. Cohoes Rolling Mill Co., Cohoes, N. Y.

Moisturator — Humidifiers. Russell & Co., W. A., Bridgeport, Conn.

Moncrief—Sheet metal pipe and fittings. Henry Furnace & Foundry Co., Cleveland, O.

Mongol—Pipe joint cement and compounds. Baer Bros., New York, N. Y.

Mono-Block — Insulation. Baldwin-Hill Co., Trenton, N. J.

Mono-Cast—Pipe. American Cast Iron Pipe Co., Birmingham, Ala.

Monoflo—Hot water heating systems and fittings. Bell & Gossett Co., Morton Grove, Ill.

Monsoon—Fans, grilles, louvers. Jamieson Mfg. Co., Dallas, Tex.

Morflex — Flexible couplings. Morse Chain Co., Ithaca, N. Y.

Mortex—Insulation. Mortell Co., J. W., Kankakee, Ill.

Mosher—Separators. Barrett Machine Co., N. S., Pittsburgh, Pa.

Motoco — Recorders, thermometers. Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.

Moto-Merco—Relays. Automatic Temperature Control Co., Inc., Philadelphia, Pa.

Motopump—Pumps. Yeomans Bros. Co., Chicago, Ill.

MotoReducer—Speed reducers. Philadelphia Gear Works, Inc., Philadelphia, Pa.

Motorstoker—Stokers. Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.

Mototurb—Ventilators. Uno Ventilator Co., Cliftondale, Mass.

Muffletone—Insulation. Celotex Corp., The, Chicago, Ill.

Multiclone—Dust collectors. Western Precipitation Corp., Los Angeles, Cal.

Multifin—Radiation. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Multiflex—Valves. Wheeler Mfg. Co., C. H., Philadelphia, Pa.

Multi-Panel—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Multiseal—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Multitherm—Air conditioning units. Clarage Fan Co., Kalamazoo, Mich.

Multivane—Fans, blowers, unit heaters. B. F. Sturtevant Co., Boston, Mass.

Multi-Wash—Dust collectors. Schneible Co., Claude B., Chicago, Ill.

Murex—Welding electrodes. Metal & Thermit Corp., New York, N. Y.

Murray—Radiation. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

N-M-D — Valves. Lunkenheimer Co., Cincinnati, O.

NYBCo Steelfin—Heating surface. New York Blower Co., Chicago, Ill.

Nalco — Boiler cleaning compounds, water treatment. National Aluminate Corp., Chicago, Ill.

National—Pumps. Austin-Mason Co., New York, N. Y.

Naturzone—Insulation. Wilson & Co., Chicago, Ill.

Nelson—Pumps. Haering Co., Inc., D. W., Chicago, Ill.

Nelson—Stokers. Heating Assurance, Inc., Spokane, Wash.

Nemo—Insulating cement. Smith & Kanzler Corp., Elizabeth, N. J.

Neverust—Exhaust heads. Straight Line Foundry & Machine Corp., Direct Separator Div., Syracuse, N. Y.

New Cyclone—Dust collectors. Kirk & Blum Mfg. Co., Cincinnati, O.

New Kathode — Electrodes. Lincoln Electric Co., Cleveland, O.

New Lightweld — Electrodes. Lincoln Electric Co., Cleveland, O.

Newarc—Welding electrodes. Electric Arc, Inc., Newark, N. J.

Niagara—Meters, strainers. Buffalo Meter Co., Buffalo, N. Y.

Nibco—Fittings, heads, joints, nozzles, valves. Northern Indiana Brass Co., Elkhart, Ind.

Ni-Resist—Pipe, welding rod. Walworth Co., New York, N. Y.

No-Grip—Shears. Wiss & Sons Co., J., Newark, N. J.

Non-clog—Sewage ejectors. Chicago Pump Co., Chicago, Ill.

Non-Clog—Pipe line strainers. Boylston Steam Specialty Co., Chicago, Ill.

Non-Clogging—Spray nozzles. Link-Belt Co., Chicago, Ill.

Non-Con-Dux—Cement, insulation. Wilson, Inc., Grant, Chicago, Ill.

Non-Flash—Brazing torches, welding and cutting apparatus. Torchweld Equipment Div., National Cylinder Gas Co., Chicago, Ill.

Non-Frost — Insulation. Keasbey & Mattison Co., Ambler, Pa.

Non-Sweat — Insulation. Keasbey & Mattison Co., Ambler, Pa.

No-Ox-Id—Protective coatings. Dearborn Chemical Co., Chicago, Ill.

Norblo—Dust collectors, fans, washers. Northern Blower Co., Cleveland, O.

Nordstrom—Valves. Merco-Nordstrom Valve Co., Pittsburgh, Pa.

Northwind—Unit air coolers. Pleasantaire Corp., Washington, D. C.

Norwesco—Cement and compounds, boiler and radiator sealing compounds. Atlas Chemical Co., Marietta, O.

No-Site—Louvers and shutters. Waterloo Register Co., Waterloo, Ia.

No Streak—Registers. Rock Island Register Co., Rock Island, Ill.

No-Thread—Fittings. Dresser Mfg. Co., Bradford, Pa.

No-Ve-U—Door ventilators. Waterloo Register Co., Waterloo, Ia.

Novoid—Insulation. Cork Import Corp., New York, N. Y.

Novus—Boilers. National Radiator Co., The, Johnstown, Pa.

Nu-Air—Air conditioning units. American Metal Products Co., Fort Worth, Texas.

Nu-Air—Fans. Meier Electric & Machine Co., Indianapolis, Ind.

Nu-Air—Ventilators. Milcor Steel Co., Milwaukee, Wis.

Nu-Alpina—Ventilators. Milcor Steel Co., Milwaukee, Wis.

Nu-Notch — Mushroom ventilators. Knowles Mushroom Ventilator Co., Montclair, N. J.

Nu-Wood—Insulation. Wood Conversion Co., St. Paul, Minn.

OB — Motor starters, valves, unions. Ohio Brass Co., Mansfield, O.

O-B Bulldog—Bolts. Ohio Brass Co., Mansfield, O.

O.E.F.—Preheaters, water heaters. Frank Heaters, Inc., Paterson, N. J.

OK—Motors. Marathon Electric Mfg. Corp., Wausau, Wis.

OK—Stocks and dies. Greenfield Tap & Die Corp., Greenfield, Mass.

Octopus — Belting. Manheim Mfg. & Belting Co., Manheim, Pa.

Ofeldt—Boilers, superheaters. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Oilbuster—Boiler cleaning compounds. Cannon Chemical Co., Everett, Mass.

Oil-Fifty—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

Oil-O-Matic — Oil burners. Williams Oil-O-Matic Heating Corp., Bloomington, Ill.

Ol' Faithful—Humidifiers. Maid-O-Mist, Inc., Chicago, Ill.

One Venturi—Heating systems. Taco Heaters, Inc., New York, N. Y.

Oriflex—Valves. Dunham Co., C. A., Chicago, Ill.

Oswego—Cutters, punches, wrenches. International Nutyp Tool Co., Oswego, N. Y.

Ovaltube—Gas burners. Beck Engineering Combustion Kompany, St. Louis, Mo.

Oxford—Unions. Standard Union Co., New York, N. Y.

Oxweld—Welding rod, welding and cutting apparatus. Linde Air Products Co., The, New York, N. Y.

PC — Air conditioning units. Buffalo Forge Co., Buffalo, N. Y.

PDQC — Pipe machines. Bignall & Keeler Machine Wks., Edwardsville, Ill.

P & H—Welding electrodes. Harnischfeger Corp., Milwaukee, Wis.

P & H—Hansen—Arc Welders. Harnischfeger Corp., Milwaukee, Wis.

P. I. V. Gear—Speed changers. Link-Belt Co., Philadelphia, Pa.

Packaged Steam—Boilers. PS Inc., Los Angeles, Cal.

Paintgrip — Sheets. American Rolling Mill Co., The, Middletown, O.

Palco—Packing. Greene, Tweed & Co., New York, N. Y.

Palco Wool-Saferized—Insulation. Pacific Lumber Co., The, San Francisco, Cal.

Palmaire—Unit heaters. Palmer Mfg. Corp., Phoenix, Ariz.

Palmetto—Packing. Greene, Tweed & Co., New York, N. Y.

Par—Condensing units. Modern Equipment Corp., Defiance, O.

Paracoil — Heaters, preheaters. Davis Engineering Corp., Elizabeth, N. J.

Paraline—Motor bases. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Parasol—Spray nozzles. Spraying Systems Co., Chicago, Ill.

Parko—Psychrometers. Parks-Cramer Co., Fitchburg, Mass.

Pathfinder—Belting. Goodyear Tire & Rubber Co., Akron, O.

Pax-Tite—Leather packing. Watson-Stillman Co., Roselle, N. J.

Pebco—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

Peer—Welders. Pier Equipment Mfg. Co., Benton Harbor, Mich.

Peerless—Dust collectors, humidifiers, air washers. New York Blower Co., Chicago, Ill.

Peerless—Pipe machines. Bignall & Keeler Machine Works, Edwardsville, Ill.

Penn-M-Co—Fittings. Penn Mfg. Corp. of Washington, Pa., Washington, Pa.

Perfection—Plates. Beaton & Cadwell Mfg. Co., New Britain, Conn.

Perfection—Regulators, valves. American District Steam Co., North Tonawanda, N. Y.

Permalined—Pipe. Jones & Laughlin Steel Corp., Pittsburgh, Pa.

Permanite—Packing. Keasbey & Mattison Co., Ambler, Pa.

Permat—Filters. Davies Air Filter Corp., New York, N. Y.

Petro—Oil burners, water heaters. Petroleum Heat & Power Co., Stamford, Conn.

Pexto — Brakes, punches, shears, wrenches. Peck, Stow & Wilcox Co., Southington, Conn.

Phantom Doorman—Door controls. Yale & Towne Mfg. Co., Stamford, Conn.

Pierce-Firebox — Boilers. Ames Iron Works, Div. of Pierce Butler Radiator Corp., Oswego, N. Y.

Pipe Master—Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Pipemaster—Wrenches. Erie Tool Wks., Erie, Pa.

Pitco—Unions. Pittsburgh Valve & Fittings Corp., Barberton, O.

Pittsburgh—Unit heaters. Automatic Gas Equipment Co., Pittsburgh, Pa.

Plandaire—Air diffusers. Connor Engineering Corp., W. B., Dorex Div., New York, N. Y.

Plasti-Calk —Caulking compounds. Chamberlin Metal Weather Strip Co., Detroit, Mich.

Plastiseal — Cement and Compounds. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Plastite—Caulking compounds. U. S. Stoneware Co., New York, N. Y.

Plastoid—Caulking compounds, furnace cement. Plastic Products Co., Detroit, Mich.

Playford—Stokers. Rosedale Foundry & Machine Co., Pittsburgh, Pa.

Plexifin—Unit heaters. Bayley Blower Co., Milwaukee, Wis.

Plexiform—Fans. Bayley Blower Co., Milwaukee, Wis.

Plumrite—Pipe. Bridgeport Brass Co., Bridgeport, Conn.

Plymco—Air filters. Plymouth Cordage Co., N. Plymouth, Mass.; Anderson Products, Inc., Cambridge, Mass. National Sales Agents.

Plymouth—Stokers. Clizbe Bros. Mfg. Co., Plymouth, Ind.

Polartron—Relays, regulators, switches. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Popular—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

Porex—Pipe line filters. General Motors Corp., Moraine Products Div., Dayton, O.

Porto-Power—Pipe benders. Blackhawk Mfg. Co., Milwaukee, Wis.

Pottsco—Insulation. Celotex Corp., The, Chicago, Ill.

Pottstown — Pumps. Allen Billmyre Corp., Mamaroneck, N. Y.

Power—Belting. Rhoads & Sons, J. E. Philadelphia, Pa.

Power Boy—Pipe cutting and threading machines. Oster Mfg. Co., Cleveland, O.

Power-Flex—Stokers. Link-Belt Co., Chicago, Ill.

Power Pak—Boilers. Orr & Sembower, Inc., Reading, Pa.

Precipitron — Air cleaners. Westinghouse Electric & Mfg. Co., Cleveland, O.

Premier—Boilers. Combustion Engineering Co., Inc., New York, N. Y.

Premier — Boilers, heaters. National Radiator, Co., The, Johnstown, Pa.

Premier—Welding rod. American Steel & Wire Co., Cleveland, O.

Pressuretrol — Regulators, switches. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Prest-O-Lite—Leak detectors, torches. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Prest-O-Weld — Welding and cutting apparatus. Linde Air Products Co., The, New York, N. Y.

Princo—Anemometers, gages, hygrometers, manometers, psychrometers, regulators, relays, thermometers, thermostats. Precision Thermometer & Instrument Co., Philadelphia, Pa.

Probestos—Gasket. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Protectomotor—Air filters. Staynew Filter Corp., Rochester, N. Y.

Protectorelay — Relays. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Protectoring—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Protectovent—Window ventilator and filter units. Staynew Filter Corp., Rochester, N. Y.

Pryzoak—Belting. Graton & Knight Co., Worcester, Mass.

Pulling—Circulators, pumps. Columbus Steam Pump Works Co., Columbus, O.

Pulverzone—Stokers. American Coal Burner Co., Chicago, Ill.

Punkah—Louvers and shutters. Kelvin-White Co., Boston, Mass.

Purox—Electrodes, welding and cutting apparatus. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Pyralux—Enamels and lacquers. du Pont de Nemours & Co. (Inc.), E. I., Fabrics & Finishes Dept., Wilmington, Del.

Pyrex — Glass pipe, gage and sight glasses. Corning Glass Wks., Corning, N. Y.

Pyro—Thermometers, recorders, regulators. Pyrometer Instrument Co., New York, N. Y.

Pyroment—Cement. Keasbey & Mattison Co., Ambler, Pa.

Q. F. R.—Pipe, tubing. Wheatland Tube Co., Philadelphia, Pa.

Q-T—Insulation. Celotex Corp., The, Chicago, Ill.

QT—Unit heaters. Kisco Boiler & Engineering Co., St. Louis, Mo.

Quartzoid—Sprinkler heads. Grinnell Co., Inc., Providence, R. I.

Quiet-Seal—Convection type radiation. Modine Mfg. Co., Racine, Wis.

Quiet Zone—Blower wheels, fans. Palmer's Mfg. Corp., Phoenix, Ariz.

Quilt—Insulation. Cabot, Inc., Samuel, Boston, Mass.

Quintuplet—Valves. Maid-O-Mist, Inc., Chicago, Ill.

RB—Couplings. Link-Belt Co., Indianapolis, Ind.

RBC—Roller bearings. Roller Bearing Co. of America, Trenton, N. J.

RB Pressure—Pressure blowers. Western Blower Co., Seattle, Wash.

R & G—Grilles, registers. Register & Grille Mfg. Co., Brooklyn, N. Y.

R-K—Combustion control systems, regulators, valves. Ruggles-Klingemann Mfg. Co., Salem, Mass.

R & M—Motors. Robbins & Myers, Inc., Springfield, O.

R & M Moyno—Pumps. Robbins & Myers, Inc., Springfield, O.

R-P Zeolite—Water treatment. Research Products Corp., Madison, Wis.

R. P. & C.—Valves. Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.

R-U-F—Fans. Reed Unit-Fans, Inc., New Orleans, La.

R-Z-U—Boilers. Fitzgibbons Boiler Co., Inc., New York, N. Y.

Race—Fans, heaters. Royal Air Conditioning Equipment Co., Alhambra, Cal.

Racine—Time switches. Reliance Automatic Lighting Co., Racine, Wis.

Radialflow—Valves. Smolensky Valve Co., Inc., Cleveland, O.

Radiatherm—Valves. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Radi-Ion—Ionization apparatus. Montgomery Bros., San Francisco, Cal.

Radolite—Cement. Pyrolite Products Co., Cleveland, O.

Rainbow Mist — Nozzles. Peterson Freezem Mfg. & Sales Co., Kansas City, Mo.

Rajah—Packing. Johns-Manville, New York, N. Y.

Ranarex—Analyzers, indicators, recorders. Permutit Co., New York, N. Y.

Rapid—Oil coolers. Bell & Gossett Co., Morton Grove, Ill.

Rapiduction—Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Rawl-Anchor—Bolts. Rawlplug Co., Inc., The, New York, N. Y.

Rawls—Bolts. Rawlplug Co., Inc., The, New York, N. Y.

Raybould — Couplings. Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Raydiant—Radiation. Weil-McLain Co., Chicago, Ill.

Reco—Air conditioning units. Refrigeration Economics Co., Inc., Canton, O.

Reco—Accumulators, condensers, headers, heaters, preheaters, tanks, unit coolers. Richmond Engineering Co., Richmond, Va.

Reco—Controllers and starters, motors. Reynolds Electric Co., Chicago, Ill.

Reco Radi-Aire—Fans. Reynolds Electric Co., Chicago, Ill.

Record-O-Stat — Recorder - Controllers. Johnson Service Co., Milwaukee, Wis.

Recoy—Chillers, condensers, cooling surface, unit coolers. Refrigeration Economics Co., Inc., Canton, O.

Red—Operators, regulators, switches, valves. Cooper Co., Clark, Philadelphia, Pa.

Red Band—Motors. Howell Electric Motors Co., Howell, Mich.

Red Devil—Cement. Pecora Paint Co., Philadelphia, Pa.

Red Diamond—Conduit, pipe. American District Steam Co., North Tonawanda, N. Y.

Red Flash—Traps. Ellis Drier Co., Chicago, Ill.

Red Head—Tongs. Billings & Spencer Co., Hartford, Conn.

Red Head—Traps. Ellis Drier Co., Chicago, Ill.

Red Top — Humidistats, thermostats. H-B Instrument Co., Philadelphia, Pa.

Redi—Stokers. General Machinery Co., Spokane, Wash.

Redi-Return—Pumps. American-Marsh Pumps, Inc., Battle Creek, Mich.

Redi-Vac—Pumps. American - Marsh Pumps, Inc., Battle Creek, Mich.

Redsquare—Boilers. Utica Radiator Corp., Utica, N. Y.

Refrak° Screen — Gas burners. Selas Co., The, Philadelphia, Pa.

Rego—Welding and cutting apparatus. Universal Power Corp., Cleveland. O.

Rego—Torches, welding and cutting apparatus. National Cylinder Gas Co., Chicago, Ill.

Relatrol—Heating systems. Automatic Temperature Control Co., Inc., Philadelphia, Pa.

Reliance—Packing. Chicago Belting Co., Chicago, Ill.

Reliance—Regulators. American Meter Co., Inc., New York, N. Y.

Reliance—Regulators. General Controls Co., Glendale, Cal.

Remco—Bases. Manley Products Corp., York, Pa.

Renewo—Valves. Lunkenheimer Co., Cincinnati, O.

Renu-Vent—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Research—Belting. Graton & Knight Co., Worcester, Mass.

Reverbolite—Insulation. Celotex Corp., The, Chicago, Ill.

Rex—Chain drives, couplings, nozzles, pillow blocks, pumps. Chain Belt Co., Milwaukee, Wis.

Rex-AC—Pillow blocks, blowers, fans. Air Controls, Inc., Cleveland, O.

Rex-Airate—Roof ventilators, blower wheels. Air Controls, Inc., Cleveland, O.

Rexoil—Burners, heaters. Reif-Rexoil, Inc., Buffalo, N. Y.

Rexvane—Fans. Sturtevant Co., B. F., Boston, Mass.

Rex-Weld—Hose. Chicago Metal Hose Corp., Maywood, Ill.

Reyn-O-Cell — Insulation. Reynolds Metals Co., Richmond, Va.

Rhino—Calking compounds. Pecora Paint Co., Philadelphia, Pa.

Richvar—Radiation. Richmond Radiator Co., Gas Products Div., Uniontown, Pa.

Ridgid—Pipe machines, wrenches, cutters, vises. Ridge Tool Co., Elyria, O.

Rifco—Unions. Rhode Island Fittings Co., Hillsgrove, R. I.

Rihco—Humidifiers. Rhode Island Humidifier & Ventilating Co., Boston, Mass.

Rip-pl—Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Rocktex—Insulation. Carey Mfg. Co., Philip, Lockland, Cincinnati, O.

Rocop—Heaters. Rome-Turney Radiator Co., Rome, N. Y.

Rodpax—Packing. National Engineering Products, Inc., Washington, D. C.

Roofvane—Ventilators. Sturtevant Co., B. F., Boston, Mass.

Roof-Vent—Ventilators. Reed Unit-Fans, Inc., New Orleans, La.

Rotameter—Flow meters. Schutte & Koerting Co., Philadelphia, Pa.

Roto Blast—Furnaces. Moncrief Furnace Co., Atlanta, Ga.

Roto-Clone—Dust collectors. American Air Filter Co., Inc., Louisville, Ky.

Rotohood—Uno Ventilator Co., Cliftondale, Mass.

Rotojet—Spray nozzles. Binks Mfg. Co., Chicago, Ill.

Rubalt—Enamels and lacquers. Hague & Co., Inc., Alfred, Brooklyn, N. Y.

Rubyfluid—Solder. Ruby Chemical Co., Columbus, O.

Runwel—Packing. Greene, Tweed & Co., New York, N. Y.

Rusco—Insulation. Russell Co., F. C., Cleveland, O.

Rustbuster—Cleaning compounds. Cannon Chemical Co., Everett, Mass.

Rustop—Boiler cleaning compounds, water treatment. Aquatic Chemical Laboratories, Inc., New York, N. Y.

SA—Valves. Lunkenheimer Co., Cincinnati, O.

S. C.—Air heaters. Surface Combustion Corp., Toledo, O.

S-N—Water heaters. Scott-Newcomb, Inc., St. Louis, Mo.

S & P—Burners, governors, preheaters, regulators, strainers, valves. Staples & Pfeiffer, Ltd., San Francisco, Cal.

Saf-Dry—Refrigerants. Liquid Carbonic Corp., The, Chicago, Ill.

Sal-Mo—Cement, insulation, packing. Sall Mountain Co., Chicago, Ill.

Sanidaire—Humidifiers. U. S. Air Conditioning Corp., Minneapolis, Minn.

Santosite—Water treatment. Monsanto Chemical Co., St. Louis, Mo.

Santrol—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Saran—Plastic tubing. Dow Chemical Co., Midland, Mich.

Saunders—Pipe cutters. Erie Tool Works, Erie, Pa.

Sauter—Time switches. Cramer Co., Inc., R. W., The, Centerbrook, Conn.

Schwan—Gas burners. Jamieson Mfg. Co., Dallas, Texas.

Scotch Giant—Refrigerating compressors. General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.

Scroll-Pivoter—Shears. Wiss & Sons Co., J., Newark, N. J.

Scru-peller—Ejectors. Chicago Pump Co., Chicago, Ill.

Sea Lion—Packing. Chicago Belting Co., Chicago, Ill.

Seal Cote—Enamels and lacquers. Fales Chemical Co., Inc., The, New York, N. Y.

Seal Master—Bearings. Stephens-Adamson Mfg. Co., Aurora, Ill.

Sealkote—Cement. Keasbey & Mattison Co., Ambler, Pa.

Seal-Less — Compressors. Westinghouse Electric & Mfg. Co., Springfield, Mass.

Seal-Rite—Cement and compounds. Macksons Co., New York, N. Y.

Seigelite — Gaskets. Johns-Manville, New York, N. Y.

Seismo-Dampers—Bases. Korfund Co., Long Island City, N. Y.

Sells—Bearings. Royersford Foundry & Machine Co., Royersford, Pa.

Sensatherm — Thermostats. Mercoid Corp., Chicago, Ill.

Sensitrol—Relays. Weston Electrical Instrument Corp., Newark, N. J.

Sentinel—Pumps. Red Jacket Mfg. Co., Davenport, Ia.

Sentry—Smoke alarms. Boiler Room Equipment, Inc., New York, N. Y.

Serrabestos—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Service—Packing. Johns-Manville, New York, N. Y.

Sesure—Gages. Yarnall-Waring Co., Philadelphia, Pa.

"77"—Pipe covering. Eagle-Picher Lead Co., Cincinnati, O.

"78"—Traps. Webster & Co., Warren, Camden, N. J.

Shawco—Bends, headers. Shaw Co., Benjamin F., Wilmington, Del.

Shelby—Tubing. National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.

Shield-Arc — Electrodes, arc welders. Lincoln Electric Co., Cleveland, O.

Shock Pads—Bases and pads. Butterworth, Jr., B. T., New Canaan, Conn.

Shut-O-Vent—Louvers and shutters. Reed Unit-Fans, Inc., New Orleans, La.

Silent Air—Fans. Belanger Fan & Blower Co., Detroit, Mich.

Silentaire — Window ventilator units. Berger Mfg. Div., Republic Steel Corp., Canton, O.

Silentblu—Gas burners. Beck Engineering Combustion Kompany, St. Louis, Mo.

Silentvane—Fans. Sturtevant Co., B. F., Boston, Mass.

Sil-Fos—Solder. Handy & Harman, New York, N. Y.

Silicair—Insulation. Western Silicair Products, Inc., Burbank, Cal.

Silverlink—Chain drives. Link-Belt Co., Indianapolis, Ind.

Silverseal—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Silverstreak—Chain drive. Link-Belt Co., Indianapolis, Ind.

Silvertop—Eliminators, traps. Anderson Co., V. D., The, Cleveland, O.

Simplex—Gages. Viking Pump Co., Cedar Falls, Ia.

Simplex—Insulation. Lucius, Wm. I., New York, N. Y.

Simplex—Pipe vises. Desmond-Stephan Mfg. Co., Urbana, O.

Simplex—Quadrants. Ohio Products Co., Cleveland, O.

Simplex — Regulators, tanks. Bell & Gossett Co., Morton Grove, Ill.

Sirocco—Blowers, dust collectors, fans, unit air conditioners, unit air coolers, unit air humidifiers, air washers. American Blower Corp., Detroit, Mich.

Smoot—Combustion control systems, regulators. Republic Flow Meters Co., Chicago, Ill.

Sno-Breze — Air conditioning units, cooling surface. Palmer Mfg. Corp., Phoenix, Ariz.

Sodrin—Boiler and radiator sealing compound. Dole Valve Co., The, Chicago, Ill.

Softweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Solray—Radiation. Weil-McLain Co., Chicago, Ill.

Sono-O-Seal—Insulation. General Insulating Products Co., Brooklyn, N. Y.

Soundliner — Insulation. Baldwin-Hill Co., Trenton, N. J.

Sovereign—Packing. Darcoid Co., Inc., New York, N. Y.

Spatter Film—Electrodes. Lincoln Electric Co., Cleveland, O.

Special X—Solder. Industrial Service Laboratories, Milwaukee, Wis.

Speed Heater—Unit heaters. Sturtevant Co., B. F., Boston, Mass.

Speedarc—Electrodes. Universal Power Corp., Cleveland, O.

Sphero—Plug valves. Fairbanks Co., New York, N. Y.

Spider Web—Air filters. Wilson & Co., Chicago, Ill.

Spiralaire—Oil burners. Westinghouse Electric & Mfg. Co., Springfield, Mass.

Spiralwound—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Spirodome — Spray nozzles. Cooling Tower Co., Inc., The, Div. of the Fluor Corp., Ltd., New York, N. Y.

Spirotallic — Gaskets. Johns-Manville, New York, N. Y.

Spirovane—Fans. Western Blower Co., Seattle, Wash.

Sporlan—Valves. Spoehrer-Lange Co., St. Louis, Mo.

Spraco—Fans, nozzles, separators, strainers, washers. Spray Engineering Co., Somerville, Mass.

Spra-Rite—Nozzles. Binks Mfg. Co., Chicago, Ill.

Spray-Acoustic—Insulation. Sprayo-Flake Co., Chicago, Ill.

Stabilflo—Valves. Foxboro Co., Foxboro, Mass.

Stable-Arc—Electrodes, arc welders. Lincoln Electric Co., Cleveland, O.

Stacon—Regulators, valves. Edison, Inc., Thomas A., Edison Electrical Controls Div., West Orange, N. J.

Staidarc—Electrodes. Universal Power Corp., Cleveland, O.

Stainarc—Electrodes. Universal Power Corp., Cleveland, O.

Stainless—Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Stainweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Standard — Convection type radiation. Modine Mfg. Co., Racine, Wis.

Standard—Humidistats. Spencer Thermostat Co., Attleboro, Mass.

Standard—Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Star—Ventilators. Merchant & Evans Co., Philadelphia, Pa.

Statictrol—Pressure and vacuum switches. Automatic Control Co., St. Louis, Mo.

Steelok—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Sterilamp—Lamps. Westinghouse Electric & Mfg. Co., Bloomfield, N. J.

Sterlco — Controls, eliminators, floats, pumps, strainers, heating systems, traps, valves. Sterling, Inc., Milwaukee, Wis.

Sterling — Compressors, condensers, valves. Reynolds Mfg. Co., Inc., Springfield, Mo.

Stictite—Cement. Refractory & Insulation Corp., New York, N. Y.

Stokerator—Stokers. Northern Steel & Stoker Co., Peoria, Ill.

Stokerelay—Relays. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Stokol—Stokers, water heaters. Schwitzer-Cummins Co., Indianapolis, Ind.

Stowe—Stokers. Johnston & Jennings Co., Cleveland, O.

Streamaire—Unit heaters, radiation, cooling surface. Young Radiator Co., Racine, Wis.

Stronghold—Belting. Rhoads & Sons, J. E., Philadelphia, Pa.

Stud-Pak—Insulation. United States Mineral Wool Co., Chicago, Ill.

Sullarc—Electrodes. Universal Power Corp., Cleveland, O.

Sunrad—Radiation. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Sunray — Boilers, radiation. United States Radiator Corp., Detroit, Mich.

Super Air Screws—Fans. Marathon Electric Mfg. Corp., Wausau, Wis.

Super Cold Fin—Cooling surface. Rempe Co., Chicago, Ill.

Super “66”—Insulation. Eagle-Picher Lead Co., Cincinnati, O.

Super 7—V belts. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Super Silvertop—Traps. Anderson Co., V. D., The, Cleveland, O.

Supercord—V belts. Browning Mfg. Co., Inc., Maysville, Ky.

Super-deLavaud—Pipe. U. S. Pipe & Foundry Co., Burlington, N. J.

Superector—Wrenches. Williams & Co., J. H., New York, N. Y.

Super-Fan—Fan blades. Norwin Co., Freeport, Ill.

Superheat—Gas burners. Selas Co., The, Philadelphia, Pa.

Superheat—Packing, Keasbey & Mattison Co., Ambler, Pa.

Superior—Fans. American Foundry & Furnace Co., Bloomington, Ill.

Superior—Wrenches. Williams & Co., J. H., New York, N. Y.

Superratchet—Ratchet wrenches. Williams & Co., J. H., New York, N. Y.

Superrench—Wrenches. Williams & Co., J. H., New York, N. Y.

Super-S—Gages. Klingerit, Inc., New York, N. Y.

Supersocket—Wrenches. Williams & Co., J. H., New York, N. Y.

Supertemp — Insulation. Eagle-Picher Lead Co., Cincinnati, O.

Supertherm—Systems. Ross Engineering Corp., J. O., New York, N. Y.

Sure Hot—Heaters, valves. Little Mfg. Co., M. S., Hartford, Conn.

Sure Return — Condensation return pumps. Chicago Pump Co., Chicago, Ill.

Sure Seal — Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Surevent—Valves. Gorton Heating Corp., Cranford, N. J.

Sureweld—Electrodes. National Cylinder Gas Co., Chicago, Ill.

Surlock—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Sweet's—Exhaust heads. Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.

Sylphon — Bellows, joints, operators, regulators, valves. Fulton Sylphon Co., Knoxville, Tenn.

Sylphon—Traps, valves. Webster & Co., Warren, Camden, N. J.

Synchro-Meter—Meters. Bailey Meter Co., Cleveland, O.

Synchrotie—Recorders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Syncretizer—Unit ventilators. Nesbitt, Inc., John J., Philadelphia, Pa.

T.T.—Smoke guns. Hill, E. Vernon, Chicago, Ill.

Tabasco — Water heaters. Kewanee Boiler Corp., Kewanee, Ill.

Tag—Humidistats, hygrometers, manometers, meters, psychrometers, recorders, regulators, thermometers, traps, valves. Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.

Tampico—Air filters. Chicago Filter Co., Joliet, Ill.

Tanktrol—Regulators. Automatic Control Co., St. Paul, Minn.

Tannate—Belting, packing. Rhoads & Sons, J. E., Philadelphia, Pa.

Tanseal—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Techni-Trol—Dampers. Waterloo Register Co., Waterloo, Ia.

Techni-Turn—Vanes. Waterloo Register Co., Waterloo, Ia.

Techni-Vane—Vanes. Waterloo Register Co., Waterloo, Ia.

Teksag Colloid—Boiler compounds. American Teksag Products Co., Inc., Mount Vernon, N. Y.

Televisor—Gages. Schutte & Koerting Co., Philadelphia, Pa.

Teltru—Anemometers, gages. Hill, E. Vernon, Chicago, Ill.

Tem-Clock (Electric)—Time switches. Penn Electric Switch Co., Goshen, Ind.

Temcoustic — Insulation. Armstrong Cork Co., Lancaster, Pa.

Temlok—Insulation. Armstrong Cork Co., Lancaster, Pa.

Temperator — Unit air conditioners. Dunham Co., C. A., Chicago, Ill.

TempOstats—Thermostats. D & M Mfg. Co., Midland Park, N. J.

Tempryte — Windows. Truscon Steel Co., Youngstown, O.

Texbord—Insulation. Celotex Corp., The, Chicago, Ill.

Texrope—V-belt drives, pulleys, v-belts. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Tharco—Cement. The Armstrong Co., Detroit, Mich.

Thawzone—Dehydrant and acid neutralizer. Highside Chemicals Co., Newark, N. J.

Therhumiter—Thermometers. Weksler Thermometer Corp., New York, N. Y.

Thermair—Furnaces, heaters. New York Blower Co., Chicago, Ill.

Thermalfin—Unit coolers. Thermal Co., Inc., Milwaukee, Wis.

Thermalfuel—Furnaces. Beck Engineering Combustion Kompany, St. Louis, Mo.

Therm-A-Lute — Cement and compounds. Superior Valve & Fittings Co., Pittsburgh, Pa.

Thermax—Insulation. Celotex Corp., The, Chicago, Ill.

Thermek—Heating and cooling surface. Peerless of America, Inc., Chicago, Ill.

Thermidaire—Burners, furnaces, heaters. Campbell Heating Co., E. K., Kansas City, Mo.

Thermix—Dust collector. Prat-Daniel Corp., Port Chester, N. Y.

Thermo—Expansion valves. Alco Valve Co., St. Louis, Mo.

Thermo—Heaters. American Furnace Co., St. Louis, Mo.

Thermochek—Controls. Bell & Gossett Co., Morton Grove, Ill.

Thermofin — Radiation. Grinnell Co., Inc., Providence, R. I.

Thermoflex—Strainers, heating systems, traps, valves. Cashin Co., W. D., Boston, Mass.

Thermoflo—Valves. Bell & Gossett Co., Morton Grove, Ill.

Thermogas—Furnaces. Beck Engineering Combustion Kompany, St. Louis, Mo.

Thermoguard—Bi-metals. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Thermoguide—Thermometers. Taylor Instrument Companies, Rochester, N. Y.

Thermoil—Furnaces. Beck Engineering Combustion Kompany, St. Louis, Mo.

Thermolier—Unit heaters. Grinnell Co., Inc., Providence, R. I.

Thermopane—Windows. Libbey-Owens Ford Glass Co., Toledo, O.

Therm-o-tile—Conduit. Porter & Co., Inc., H. W., Newark, N. J.

Thermotrol—Valves. Sterling Engineering Co., Milwaukee, Wis.

Thermovent—Unit ventilators. Nesbitt, Inc., John J., Philadelphia, Pa.

Thermovoir — Water heaters. Bell & Gossett Co., Morton Grove, Ill.

Thin Man—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

“31” Series—Propeller fans. Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.

Thor—Belting. Goodyear Tire & Rubber Co., Akron, O.

Thor—Drills, pumps. Independent Pneumatic Tool Co., Chicago, Ill.

Thredolets—Fittings. Bonney Forge & Tool Wks., Allentown, Pa.

Thrift—Air heaters. Surface Combustion Corp., Toledo, O.

Thrift—Switches. Tork Clock Co., Inc., Mt. Vernon, N. Y.

Throway—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Ti-Compact — Boilers. Titusville Iron Works Co., Titusville, Pa.

Ticone—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Tighton—Unions. Standard Union Co., New York, N. Y.

Timercoid—Time switches. Mercoid Corp., Chicago, Ill.

Timerelay—Relays. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Timetrol (Manual) — Time switches. Penn Electric Switch Co., Goshen, Ind.

Tin-Loy — Solder. Eagle-Picher Lead Co., Cincinnati, O.

Tiny—Traps. Nason Co., Detroit, Mich.

Tiscot—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Titan—Traps. Nason Co., Detroit, Mich.

Tite — Caulking compounds. Krehbiel Co., J. H., Chicago, Ill.

Tite Seal—Cement and compounds. Radiator Specialty Co., Charlotte, N. C.

Tom Thumb—Pipe machines. Oster Mfg. Co., Cleveland, O.

Toncan—Pipe, sheets. Republic Steel Corp., Cleveland, O.

Toncanarc—Electrodes. Universal Power Corp., Cleveland, O.

Toolweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Torkflash—Wrenches. Blackhawk Mfg. Co., Milwaukee, Wis.

Torqometer — Torque indicating wrenches. Snap-On Tools Corp., Kenosha, Wis.

Transite — Pipe, refractories. Johns-Manville, New York, N. Y.

Trans-Lux — Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Transweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Tray—Cooling towers, condensers. New England Cooling Tower Co., Boston, Mass.

Treet-O-Control—Water treatment. % Proportioneers, Inc. %, Providence, R. I.

Treet-O-Unit—Pumps, % Proportioneers, Inc. %, Providence, R. I.

Trem-Bar—Insulation. United States Gypsum Co., Chicago, Ill.

Tri-Clad—Motors. General Electric Co., Schenectady, N. Y.

Trident—Meters. Neptune Meter Co., New York, N. Y.

Trimo—Cutters, vises, wrenches. Trimont Mfg. Co., Boston, Mass.

Trimo—Cutters. Erie Tool Works, Erie, Pa.

Tripl-Disc — Valves. Rockford Brass Works, Rockford, Ill.

Triple Duty—Boilers. Bass Foundry & Machine Co., Ft. Wayne, Ind.

Triple Duty—Heating systems. Bell & Gossett Co., Morton Grove, Ill.

Tripl-Mix—Cement. Krehbiel Co., J. H., Chicago, Ill.

Tri-Sil—Dampers. Tuttle & Bailey, Inc., New Britain, Conn.

Tri-trol—Regulator, switches, thermostats. Marsh Corp., Jas. P., Chicago, Ill.

Triumph—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Trojan—Boilers, Burnham Boiler Corp., Irvington, N. Y.

Truflex—Bi-metals. General Plate Div., Metals & Controls Corp., Attleboro, Mass.

Tuffernell—Cement. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Turbo—Air washers, spray nozzles. Bayley Blower Co., Milwaukee, Wis.

Turbo Vane—Fans and blowers. B. F. Sturtevant Co., Boston, Mass.

Turboflo — Convection type radiation. Modine Mfg. Co., Racine, Wis.

Turret — Pumps. Yeomans Bros. Co., Chicago, Ill.

Tuway—Strainers. Wright-Austin Co., Detroit, Mich.

20th Century—Bearings. Roller Bearing Co. of America, Trenton, N. J.

Twin Contact—Controls. Perfex Corp. (Controls Div.), Milwaukee, Wis.

Two Way—Dampers. Tuttle & Bailey, Inc., New Britain, Conn.

Tygon—Protective coatings. U. S. Stoneware Co., New York, N. Y.

Tymit—Switches. Tork Clock Co., Inc., Mt. Vernon, N. Y.

Type ME—Blower wheels, fans. New York Blower Co., Chicago, Ill.

Tytecote—Insulation. Specialty Converters, Inc., East Braintree, Mass.

UAC—Unit air conditioners. Burnham Boiler Corp., Irvington, N. Y.

UAC—Unit heaters. Surface Combustion Corp., Toledo, O.

UACD—Unit heaters. Surface Combustion Corp., Toledo, O.

UAS—Unit heaters. Surface Combustion Corp., Toledo, O.

U. F. S.—Clamps. Grinnell Co., Inc., Providence, R. I.

U. S.—Unions. United Superior Union Co., Inc., Brooklyn, N. Y.

USS—Sheets, structural shapes. Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

U. S. Airco—Air conditioning equipment, speed changers. U. S. Air Conditioning Corp., Minneapolis, Minn.

UTA—Pumps. American-Marsh Pumps, Inc., Battle Creek, Mich.

U-Loy—Sheets. Republic Steel Corp., Cleveland, O.

Unaflo — Steam engines. Ames Iron Works, Div. of Pierce Butler Radiator Corp., Oswego, N. Y.

Uniblade—Fans. Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.

Unicoils—Air conditioning unit. Clarage Fan Co., Kalamazoo, Mich.

Unicool—Humidifiers, unit air conditioners, unit air humidifiers, air washers. Betz Unit Air Cooler Co., Kansas City, Mo.

Uni-fin—Grilles, registers. Barber-Colman Co., Rockford, Ill.

Uni-flo—Air diffusers, dampers, grilles. Barber-Colman Co., Rockford, Ill.

Uniflow—Oil burners. Ace Engineering Co., Chicago, Ill.

Uniplastic—Furnace and insulating cement. Robinson Insulation Co., Great Falls, Mont.

Unisorb—Bases and pads, insulation. Felters Co., Inc., Boston, Mass.

Unitaire—Unit air conditioners. Westinghouse Electric & Mfg. Co., Springfield, Mass.

Unitem—Heaters. Bell & Gossett Co., Morton Grove, Ill.

Unitherm—Unit heaters and coolers. Clarage Fan Co., Kalamazoo, Mich.

Unitrol—Regulators, switches, thermostats. Marsh Tritrol Co., Chicago, Ill.

Universal—Benders. Hossfeld Mfg. Co., Winona, Minn.

Universal—Air filters. Hugo Mfg. Co., West Duluth, Minn.

Universal—Centrifugal pumps. Bell & Gossett Co., Morton Grove, Ill.

Universal—Gages. Rochester Mfg. Co., Inc., Rochester, N. Y.

Universal—Gas and oil burners. Mettler Co., Lee B., Los Angeles, Cal.

Universal — Packing. Johns-Manville, New York, N. Y.

Universal—Regulators. Dockson Corp., Detroit, Mich.

Universal—Vibration eliminators. Butterworth, B. T., Jr., New Canaan, Conn.

Upson—Bolts and studs. Republic Steel Corp., Bolt & Nut Div., Cleveland, O.

Utica—Radiation. International Heater Co., Utica, N. Y.

Utility — Compressors. Schramm, Inc., West Chester, Pa.

Utility—Packing. Keasbey & Mattison Co., Ambler, Pa.

Utilus—Fans. Hirschman Co., W. F., Buffalo, N. Y.

Vacu-Draft—Blowers. Muncie Gear Wks., Inc., Muncie, Ind.

Vacuumstat — Switches. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Valcalox—Damper regulators. Young Regulator Co., Cleveland, O.

Valpit—Unions. Pittsburgh Valve & Fittings Corp., Barberton, O.

Vaporstat—Switches. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Vari-Pitch—Speed changers. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Veelos—V-belts. Manheim Mfg. & Belting Co., Manheim, Pa.

Velometer—Air velocity meters. Illinois Testing Laboratories, Inc., Chicago, Ill.

Velvet—Cement. Keasbey & Mattison Co., Ambler, Pa.

Vent-Vac—Heating systems. Anderson Products, Inc., Cambridge, Mass.

Ventil-aire—Window ventilator and filter units. Fairbanks, Morse & Co., Chicago, Ill.

Vento — Heating surface. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Vent-Rite—Air valves, air eliminators. Anderson Products, Inc., Cambridge, Mass.

Ventura—Fans. American Blower Corp., Detroit, Mich.

Venturafin—Unit heaters. American Blower Corp., Detroit, Mich.

Venturi — Fan housings. Commercial Shearing & Stamping Co., Youngstown, O.

Venturi — Meters. Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.

Venturi-Flo—Air diffusers. Barber-Colman Co., Rockford, Ill.

Vermiculite — Insulation. International Vermiculite Co., Springfield, Ill.

Vernier-Set—Time switches. Automatic Temperature Control Co., Inc., Philadelphia, Pa.

Vertiflow—Unit heaters. Young Radiator Co., Racine, Wis.

V-Flat—Pulleys and sheaves. Dayton Rubber Mfg. Co., Dayton, O.

Vibracork—Bases. Armstrong Cork Co., Lancaster, Pa.

Vibro Insulators—Bases. Goodrich Co., B. F., Akron, O.

Vibro-Dampers — Bases. Korfund Co., Long Island City, N. Y.

Victor—Regulators. Atlas Valve Co., Inc., Newark, N. J.

Victor—Steam traps. Wright-Austin Co., Detroit, Mich.

Vistand—Vise stands. Armstrong Mfg. Co., Bridgeport, Conn.

Vitalaire—Air conditioning units. Ice Cooling Appliance Corp., Morrison, Ill.

Vitalloy—Wrenches. Billings & Spencer Co., Hartford, Conn.

Vitra-Carlite—Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Vitriram—Furnace cement. U. S. Stoneware Co., New York, N. Y.

V-Meth-L — Refrigerant. Virginia Smelting Co., West Norfolk, Va.

Volcano—Ventilators. Iwan Brothers, South Bend, Ind.

Vol-U-Trol — Dampers. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Vortex—Pumps. Lawrence Pump & Engine Co., Lawrence, Mass.

Vortex—Nozzles. Phillips Cooling Tower Co., Inc., New York, N. Y.

V-tite—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

V-to-V—Pulleys and sheaves. Dayton Rubber Mfg. Co., Dayton, O.

Vulcalock—Fittings, pipe, tanks, valves. Goodrich Co., B. F., Akron, O.

Vulcan—Stands, tongs, vises. Williams & Co., J. H., New York, N. Y.

Vulcan—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Vulco — Belts, drives. Gates Rubber Co., Denver, Col.

WHS—Couplings, pulleys and sheaves, reducers. Smith, Inc., Winfield H., Springville, N. Y.

WJ—Boiler cleaning compound. Radiator Specialty Co., Charlotte, N. C.

W. & McD.—Strainers, valves. Watson & McDaniel Co., Philadelphia, Pa.

W-S—Fittings. Watson Stillman Co., Roselle, N. J.

Walco-Parmelee—Wrenches. Walworth Co., New York, N. Y.

Wallvane—Fans. Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Walseal Silbraz—Fittings, valves. Walworth Co., New York, N. Y.

Warco—Valves. Russell & Co., W. A., Bridgeport, Conn.

Wat-a-mat—Water meters. Pfening Co., Fred D., Columbus, O.

Watco—Cooling towers, spray nozzles, spraying systems. Water Cooling Corp., New York, N. Y.

Water-Boy—Feeders. Maid-O-Mist, Inc., Chicago, Ill.

Water-Ray-Trola — Heaters. Ray Oil Burner Co., San Francisco, Cal.

Weaco—Preheaters, thermostats. Warren Electric Appliance Co., Warren, Pa.

Wear-Proof—Pumps. Schneible Co., Claude B., Chicago, Ill.

Wearweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Weathermaker—Unit air conditioners. Carrier Corp., Syracuse, N. Y.

Weathermaster—Unit air conditioners. Carrier Corp., Syracuse, N. Y.

Weatherstat—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Weatherwood—Insulation. United States Gypsum Co., Chicago, Ill.

Webster-Nesbitt—Unit heaters. Webster & Co., Camden, N. J.

Webster-Nesbitt—Unit heaters and air conditioners. Nesbitt, Inc., John J., Philadelphia, Pa.

Weco—Gas burners. Webster Engineering Co., Tulsa, Okla.

Wedgbelt—V belts and v-belt drives, pulleys. American Pulley Co., Philadephia, Pa.

Weldells—Welding fittings. Taylor Forge & Pipe Works, Chicago, Ill.

Weldfast—Welding rod. Revere Copper and Brass, Incorporated, New York, N. Y.

Weld-Master—Arc welders. Ideal Commutator Dresser Co., Sycamore, Ill.

Weldolets—Fittings. Bonney Forge & Tool Works, Allentown, Pa.

Weldomatic—Arc welders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Weldotrol—Spot welders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Weld-O-Tron—Arc welders. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Westco—Pumps. Micro-Westco, Inc., Bettendorf, Ia.

Whirljet—Spray nozzles. Spraying Systems Co., Chicago, Ill.

White Rock—Insulation. Celotex Corp., The, Chicago, Ill.

Whiz—Drills. Paramount Products Co., New York, N. Y.

Wilco—Bi-metals. Wilson Co., H. A., The, Newark, N. J.

Wilco—Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Willie Williams — Pipe cutting and threading machines. Oster Mfg. Co., Cleveland, O.

Wilson—Arc welders. Air Reduction Sales Co., New York, N. Y.

Windowstat—Condensation control. Friez & Sons, Julien P., Baltimore, Md.

Wind-O-Vane—Propeller fans. Sturtevant Co., B. F., Boston, Mass.

Wind-O-Vent—Window ventilator and filter units. Reed Unit-Fans, Inc., New Orleans, La.

Wing-Scruplex — Fans, ventilators. Wing Mfg. Co., L. J., New York, N. Y.

Wire-Klad—Air filters. Staynew Filter Corp., Rochester, N. Y.

Wissco—Grilles, welding rod. Wickwire Spencer Steel Co., New York, N. Y.

Witch—Hangers, protectors. Carpenter & Paterson, Inc., East Boston, Mass.

Witch-T. D.—Valves. Carpenter & Paterson, Inc., East Boston, Mass.

Wizardaire—Air conditioning units, humidifiers. Certified Products Co., Toledo, O.

Wolverine—Fans, ventilators. Belanger Fan & Blower Co., Detroit, Mich.

Wrigley—Bolts. Chicago Expansion Bolt Co., Chicago, Ill.

X-L — Gaskets, packing. Excelsior Leather Washer Co., Rockford, Ill.

Xacto—Meters. Bowser & Co., Inc., S. F., Fort Wayne, Ind.

Xit—Ventilators. Iona Ventilator Co., Inc., Philadelphia, Pa.

Yager—Solder. Benson Co., Inc., Alex R., Hudson, N. Y.

Yarway — Alarms, clamps, expansion joints, nozzles, strainers, traps, valves. Yarnall-Waring Co., Philadelphia, Pa.

Yello-Jacket—Heating boilers. Burnham Boiler Corp., Irvington, N. Y.

Yorkaire—Unit air coolers. York Ice Machinery Corp., York, Pa.

Zeph-o-Cone—Air diffusers. Waterloo Register Co., Waterloo, Ia.

Zincgrip — Sheets. American Rolling Mill Co., Middletown, O.

Zonolite—Insulation. Munn and Steele, Inc., Newark, N. J.

Zonolite—Insulation. Robinson Insulation Co., Great Falls, Mont.

DIRECTORY SECTION
HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS
PART 3—MANUFACTURERS' ADDRESSES

A

Accurate Mfg. Works, 2336-38 Milwaukee Ave., Chicago, Ill.
Accurate Metal Weather Strip Co., 216 E. 26th St., New York, N. Y.
Ace Engineering Co., 848 N. Noble St., Chicago, Ill.
Acer & Whedon, Medina, N. Y.
Acheson Mfg. Co., Braddock P. O., Rankin, Pa.
Acker Organization, Inc., W. M., 3167 Fulton Rd., Cleveland, O.
Ackermann Mfg. Co., Wheeling, W. Va.
Acme Asbestos Covering & Flooring Co., 236 N. Elizabeth St., Chicago, Ill.
Acme Electric Welder Co., 2618 Fruitland Rd., Los Angeles, Cal.
Acme Heating & Ventilating Co., Inc., 4224 Lowe Ave., Chicago, Ill.
Acme Industries, Inc., Cor. Mechanic and Ganson Sts., Jackson, Mich.
Acme Refining Co., The, W. 56th & W. & L. E. Ry., Cleveland, O.
Acme Tin Plate & Roofing Supply Co., 3rd and Westmoreland Sts., Philadelphia, Pa.
Acme White Lead & Color Works, 8250 St. Aubin Ave., Detroit, Mich.
Acorn Refining Co., 8001 Franklin Ave., Cleveland, O
Activator Process Sales Co., 501 S. Marengo Ave., Alhambra, Cal.
Adam Electric Co., Frank, 3650 Windsor St., St. Louis, Mo.
Adams Co., The, E. 4th St., Dubuque, Ia
Adams Co., Inc., R. P., 55 Chicago St., Buffalo, N. Y.
Ad-Lee Co., Inc., 825 S. Wabash Ave., Chicago, Ill.
Advance Aluminum Castings Corp., 2742 W. 36th Pl., Chicago, Ill.
Advance Electric Co., 1260 W. Second St., Los Angeles, Cal.
Advance Fan & Blower Co., 3428 Bagley, Detroit, Mich.
Advance Insulating Co., Magee Bldg., Pittsburgh, Pa.
Advanced Refrigerating Systems Co., 33rd and Arch Sts., Philadelphia, Pa.
Aeco Packing Products Co., 215 W. Illinois St., Chicago, Ill.
Aeolus Dickinson Co., 3320 S. Artesian Ave., Chicago, Ill.
●Aerofin Corp., 410 S. Geddes St., Syracuse, N. Y.
Aeroil Burner Co., Inc., Park Ave. at 57th St., West New York, N. J.
Aerovent Fan Co., 710 E. Ash St., Piqua, O.
Agnew Electric Co., Milford, Mich.
Ahlberg Bearing Co., 3081 W. 47th St., Chicago, Ill.
Air Conditioning Products Co., 1230-18th St., Detroit, Mich.
Air Control Products, Inc., Glades St. and Larch, Muskegon, Mich.
Air Controls, Inc., 1935 W. 114th St., Cleveland, O.
Air Devices, Inc., 17 E. 42nd St., New York, N. Y.
Air Equipment Co., 2405 W. 44th St., Denver, Colo.
Air Filter Engineering Co., 2236 S. Wabash Ave., Chicago, Ill.
●Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y.
●Air & Refrigeration Corp., 475 Fifth Ave., New York, N. Y.
Aire-Foile Fan & Blower Co., 4737 W. Vernor Highway, Detroit, Mich.
Airgard Mfg. Co., 609 N. La Salle St., Chicago, Ill.
Airmaster Corp., 4317 Ravenswood Ave., Chicago, Ill.
●Air-Maze Corp., 5200 Harvard Ave., Cleveland, O.
Airmode Mfg. Co., 325 W. Huron St., Chicago, Ill.
Airo Supply Co., 2726 N. Ashland Ave., Chicago, Ill.
AirO-Fin Register Co., 19159 John R St., Detroit, Mich.
Air-O-Cel Industries, Inc., 11616 Cloverdale Ave., Detroit, Mich.
Air-O-Line Co., The, 2118 Griffin St., Dallas, Tex.
Airox Co., 305 E. 46th St., New York, N. Y.
Air-Stream Filter Corp., 2100 Washington Ave., St. Louis, Mo.
Airtemp, Div. of Chrysler Corp., Leo St., Dayton, O.
●Airtherm Mfg. Co., 700 S. Spring Ave., St. Louis, Mo.
Airwasher Corp., 1122 N. Washington Ave., Lansing, Mich.
Ajax Flexible Coupling Co., Westfield, N. Y.
Akrat Ventilator Co., 1717 Carroll Ave., Chicago, Ill.
Akron Metallic Gasket Co., 155 N. Union, Akron, O.
Akwa Heaters, Inc., 1955 Park Ave., New York, N. Y.
Alabama Pipe Co., Anniston, Ala.
Albright Equipment Co., 405 Penn Ave., Pittsburgh, Pa.
●Alco Valve Co., 2628 Big Bend Blvd., St. Louis, Mo.
Aldrich Pump Co., 4 Pine St., Allentown, Pa.
Alexander Bros., 406 N. 3rd, Philadelphia, Pa.
Alfol Insulation Co., Inc., 155 E. 44th St., New York, N. Y.
All Metal Weatherstrip Co., 229 W. Illinois St., Chicago, Ill.
Allegheny Ludlum Steel Corp., 2319 Oliver Bldg. (22), Pittsburgh, Pa.
Allen Billmyre Corp., 431 Fayette Ave., Mamaroneck, N. Y.
●Allen-Bradley Co., 1335 S. First St., Milwaukee, Wis.
Allen Corp., 9767 Erwin Ave., Detroit, Mich.
Allied Welding Crafts, Inc., 401 W. South St., Indianapolis, Ind.
Allington & Curtis Mfg. Co., 1500 Holland Ave., Saginaw, Mich.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Allis Co., Louis, The, 427 E. Stewart St., Milwaukee, Wis.
Alloy Steel Products Co., 1000 W. Elizabeth Ave., Linden, N. J.
Allpax Co., Inc., Mamaroneck, N. Y.
All-Vac Steam System, 500 N. Dearborn St., Chicago, Ill.
Alpha Metal & Rolling Mills, Inc., 363 Hudson Ave., Brooklyn, N. Y.
Alphil Spot Welding Co., 431 W. Broadway, New York, N. Y.
Alten's Foundry & Machine Works, 226 W. Wheeling St., Lancaster, O.
Alter Co., Harry, 1728 S. Michigan Ave., Chicago, Ill.
Alter-Arc Mfg. Co., 209 B St., Lawton, Okla.
Alton Mineral Wool Insulation Co., P. O. Box 268, Alton, Ill.
Aluminum Aircell Insulation Co., Curtis Bldg., Detroit, Mich.
Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh, Pa.
American Agile Corp., 5806 Hough Ave., Cleveland, O.
American Air Conditioning Co., Boulevard Bldg., Detroit, Mich.
●American Air Filter Co., Inc., 107 Central Ave., Louisville, Ky.
American Barlock Co., Inc., 36-32 38th St., Long Island City, N. Y.
American Blower Corp., 6000 Russell St., Detroit, Mich.
●American Brass Co., 414 Meadow St., Waterbury, Conn.
American Car & Foundry Co., 36 Church St., New York, N. Y.
American Cast Iron Pipe Co., 2930 N. 16th St., Birmingham, Ala.
American Coal Burner Co., 155 E. Superior St., Chicago, Ill.
American Coils, Inc., 25-27 Lexington St., Newark, N. J.
American Coolair Corp., 3604 Mayflower St., Jacksonville, Fla.
American Cooling Tower Co., 2710 McGee St., Kansas City, Mo.
●American District Steam Co., Bryant St., North Tonawanda, N. Y.
American Engineering Co., Aramingo Ave. and Cumberland St., Philadelphia, Pa.
American Flange & Mfg. Co., Inc., 1901 R. C. A. Bldg., New York, N. Y.
American Flexible Coupling Co., 1801 Pittsburgh Ave., Erie, Pa.
American Foundry Equipment Co., 619 S. Byrkit St., Mishawaka, Ind.
American Foundry & Furnace Co., Washington St. at McClun, Bloomington, Ill.
American Furnace Co., 2719-31 Delmar Blvd., St. Louis, Mo.
American Hair & Felt Co., 1828 Merchandise Mart, Chicago, Ill.
American Hammered Piston Ring Div., Koppers Co., Bush and Hamburg Sts., Baltimore, Md.
American Hard Rubber Co., 11 Mercer St., New York, N. Y.
American Injector Co., 1481-14th St., Detroit, Mich.
American Instrument Co., Silver Spring, Md.
American K. A. T. Corp., 122 E. 42nd St., New York, N. Y.
American-Larson Ventilating Co., 1004 Keystone Bank Bldg., Pittsburgh, Pa.
American Locomotive Co., Alco Products Div., 30 Church St., New York, N. Y.
American Locomotive Co., Diesel Engine Div., Auburn, N. Y.
American Manganese Bronze Co., Rhawn & Hegerman Sts., Philadelphia, Pa.
American-Marsh Pumps, Inc., 60 Capital Ave., N. E., Battle Creek, Mich.
American Metal Hose Branch, American Brass Co., 67 Jewelry St., Waterbury, Conn.
American Metal Products Co., 730 Hudgins St., Forth Worth, Tex.
American Metal Weather Strip Co., 144 N. Division Ave., Grand Rapids, Mich.
American Meter Co., Inc., 60 E. 42nd St., New York, N. Y.
American Moistening Co., 260 W. Exchange St., Providence, R. I.
American Nickeloid Co., 113 Second St., Peru, Ill.
American Pipe Bending Machine Co., Inc., 37 Pearl St., Boston, Mass.
American Pipe Tool Co., 4856 W. Kinzie St., Chicago, Ill.
American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa.

● Advertisement in this issue. See Index to Advertisers, page 326.

American Radiator & Standard Sanitary Corp., Bessemer Bldg., Pittsburgh, Pa.

American Rolling Mill Co., The, 703 Curtis St., Middletown, O.

American Schaefer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., 11 Elias St., Bridgeport, Conn.

American Sheet Metal Works, 331 N. Alexander, New Orleans, La.

●American Solder & Flux Co., 2152 E. Norris St., Philadelphia, Pa.

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.

American Sterilizer Co., Erie, Pa.

American Teksag Products Co., Inc., 395 N. MacQuesten Pkwy., Mt. Vernon, N. Y.

American Thermometer Co., 2907 Clark Ave., St. Louis, Mo.

American Warming & Ventilating Co., 1017-1021 Summit St., Toledo, O.

American Water Softener Co., Lehigh Ave. and 4th St., Philadelphia, Pa.

American Well Wks., 100 N. Broadway, Aurora, Ill.

American Zinc Products Co., Greencastle, Ind.

Ames Co., W. R., 150 Hooper St., San Francisco, Cal.

●Ames Hydrovac Corp., 290 Scholes St., Brooklyn, N. Y.

Ames Iron Works, Division of Pierce Butler Radiator Corp., Oswego, N. Y.

Amirton Co., Inc., 27 Pearl St., New York, N. Y.

Anchor Packing Co., 401 N. Broad St., Philadelphia, Pa.

Anchor Stove & Range Co., Third & Culbertson Sts., New Albany, Ind.

Andale Co., 1604 Arch, Philadelphia, Pa.

Andersen Corp., Bayport, Minn.

●Anderson Co., V. D., The, 1949 W. 96th St., Cleveland, O.

Anderson Engine & Foundry Co., Anderson, Ind.

Anderson Mfg. Co., 511 Third, Des Moines, Ia.

●Anderson Products, Inc., 17 Tudor St., Cambridge, Mass.

Andrews Lead Co., Inc., 30-48 Greenpoint Ave., Long Island City, N. Y.

●Anemostat Corp. of America, 10 E. 39th St., New York, N. Y.

Anetsberger Bros., 3505 Elston Ave., Chicago, Ill.

Annis Air Filters, 1515 Gardena St., Glendale, Cal.

Ansul Chemical Co., Marinette, Wis.

Apex Rotarex Corp., 1070 E. 152nd St., Cleveland, O.

Apollo Steel Co., 609 Warren Ave., Apollo, Pa.

April Showers Co., 4126 Eighth St., N.W., Washington, D. C.

Aqua-Mist Co., 426 Jefferson St., Topeka, Kans.

Aqua-Sorb Co., 21 S. 16th St., East Orange, N. J.

Aquatic Chemical Laboratories, Inc., 95 Liberty St., New York, N. Y.

Arcos Corp., 401 N. Broad St., Philadelphia, Pa.

Arcweld Mfg. Co., Inc., 3469 Third Ave., W., Seattle, Wash.

Arex Co., 333 N. Michigan Ave., Chicago, Ill.

Armour Ammonia Works, 1355 W. 31st St., Chicago, Ill.

Armstrong-Blum Mfg. Co., 5700 Bloomingdale Rd., Chicago, Ill.

Armstrong Bros. Tool Co., 317-357 N. Francisco Ave., Chicago, Ill.

Armstrong Co., The, Post Ave. and South St., Detroit, Mich.

Armstrong Cork Co., 994 Concord St., Lancaster, Pa.

Armstrong Heat Control Co., 1626 N.E. Union Ave., Portland, Ore.

●Armstrong Machine Wks., 874 Maple St., Three Rivers, Mich.

Armstrong Mfg. Co., 303 Knowlton St., Bridgeport, Conn.

Arrow-Hart & Hegeman Elect. Co., 103 Hawthorn St., Hartford, Conn.

Art Valve Co., 4237 N. Lincoln, Chicago, Ill.

Ashcroft Gauge Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Ashton Valve Co., 161-1st St., Cambridge, Mass.

Askania Regulator Co., 1605 S. Michigan Ave., Chicago, Ill.

Asphalt Products Co., Eastwood Sta., Syracuse, N. Y.

Athey Co., 6035-43 W. 65th St., Chicago, Ill.

Atkins & Co., E. C., 402 S. Illinois St., Indianapolis, Ind.

Atlantic Metal Hose Co., Inc., 123 W. 64th St., New York, N. Y.

Atlantic Steel Boiler Co., 21st St. and Washington Ave., Philadelphia, Pa.

Atlas Chemical Co., Marietta, O.

Atlas Heating & Ventilating Co., Ltd., 557 Fourth St., San Francisco, Cal.

Atlas Valve Co., Inc., 282 South St., Newark, N. J.

Auburn Foundry Inc., Stoker Div., Auburn, Ind.

●Auditorium Conditioning Corp., 17 E. 42nd St., New York, N. Y.

●Auer Register Co., 3608 Payne Ave., Cleveland, O.

Aurora Pump Co., 619 Loucks St., Aurora, Ill.

Austin-Mason Co., 15 Park Row, New York, N. Y.

Au-Temp-Co Corp., 33 W. 60th St., New York, N. Y.

Autoforce Ventilating System, 53 Devonshire St., Boston, Mass.

Automatic Control Co., 1005 University Ave., St. Paul, Minn.

Automatic Gas Equipment Co., 301 Brushton Ave., Pittsburgh, Pa.

●Automatic Products Co., 2460 N. 32nd St., Milwaukee, Wis.

Automatic Pump & Softener Corp., 1907 Kishwaukee St., Rockford, Ill.

Automatic Stoker Corp., 2427 W. North Ave., Milwaukee, Wis.

Automatic Switch Co., 41 E. 11th St., New York, N. Y.

Automatic Temperature Control Co., Inc., 33 E. Logan St., Philadelphia, Pa.

Automatic Ventilator Co., 503 S. Shiawasse, Corunna, Mich.

Automotive Maintenance Machinery Co., North Chicago, Ill.

Autovent Fan & Blower Div., The Herman Nelson Corp., 1811-27 N. Kostner Ave., Chicago, Ill.

Azor Corp., Newark, N. J.

B

Babcock & Wilcox Co., 85 Liberty St., New York, N. Y.

Bacharach Industrial Instrument Co., 7000 Bennett St., Pittsburgh, Pa.

Bache & Co., Semon, Greenwich & Morton Sts., New York, N. Y.

Badger & Sons Co., E. B., 75 Pitts St., Boston, Mass.

Badger Fire Extinguisher Co., 31 St. James Ave., Boston, Mass.

Baer Bros., 438 W. 37th St., New York, N. Y.

Bahnson Co., R. J., 1001 S. Marshall St., Winston-Salem, N. C.

Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, O.

●Baker Ice Machine Co., Inc., 1508 Evans St., Omaha, Nebr.

Baldor Electric Co., 4353 Duncan Ave., St. Louis, Mo.

●Baldwin-Hill Co., 527 Klagg Ave., Trenton, N. J.

Ballantyne Co., 222 N. 16th St., Omaha, Nebr.

Balloffet Dies and Nozzle Co., Inc., 45-51 Adams St., Guttenberg, N. J.

Baltimore Air Coil Co., 410 W. Redwood St., Baltimore, Md.

Bantam Bearings Corp., South Bend, Ind.

Barber Asphalt Corp., Barber, N. J.

Barber Gas Burner Co., 3704 Superior Ave., Cleveland, O.

●Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Barclay, Inc., Robert, 128 N. Peoria St., Chicago, Ill.

Barco Mfg. Co., 1801 Winnemac Ave., Chicago, Ill.

Bardco Corp. of America, 6670 Lexington Ave., Los Angeles, Cal.

Barium Stainless Steel Corp., 1502 Allen Ave., S. E., Canton, O.

Barland Weatherstrip Material Co., 5600 Curtis Ave., Cleveland, O.

Barnes Co., W. F. & John, Rockford, Ill,

Barnes & Jones, Inc., 128 Brookside 'Ave., Jamaica Plain, Boston, Mass.

Barnes Tool Co., The, 152 Brewery St., New Haven, Conn.

Barrett Div., The, Allied Chemical & Dye Corp., 40 Rector St., New York, N. Y.

Barrett, Haentjens & Co., Hazleton, Pa.

Barrett Machine Co., 912-916 Behan St., N. S., Pittsburgh, Pa.

Bartlett Mfg. Co., 3003 E. Grand Blvd., Detroit, Mich.

Bass Foundry & Machine Co., 1602-1734 Hanna St., Ft. Wayne, Ind.

Bausch & Lomb Optical Co., 635 St. Paul St., Rochester, N. Y.

Bayer Co., 4030 Chouteau Ave., St. Louis, Mo.

Bayley Blower Co., 1817 S. 66th St., Milwaukee, Wis.

Beach-Russ Co., 64A Church St., New York, N. Y.

Beacon-Morris Corp., 702 Beacon St., Boston, Mass.

Bear Mfg. Co., Rock Island, Ill.

Bearings Co. of America, 501 Harrisburg Ave., Lancaster, Pa.

Beaton & Cadwell Mfg. Co., 185 Main St., New Britain, Conn.

Beaton & Corbin Mfg. Co., Southington, Conn.

Beatty Machine & Mfg. Co., 934 150th St., Hammond, Ind.

Beaver Pipe Tools, Inc., Keeney Ave., Warren, O.

Beck Engineering Combustion Kompany, 3033 Spruce St., St. Louis, Mo.

Beckley Perforating Co., 315 North Ave., Garwood, N. J.

Belanger Fan & Blower Co., 1230 18th St., Detroit, Mich.

Belco Exhaust Fan Mfg. Co., 3810 Olive St., St. Louis, Mo.

Belfield Co., H., 435 N. Broad St., Philadelphia, Pa.

Belknap Mfg. Co., 800 Union Ave., Bridgeport, Conn.

●Bell & Gossett Co., Morton Grove, Ill.

Belmont Packing & Rubber Co., The, Butler & Sepviva Sts., Philadelphia, Pa.

Belmont Smelting & Refining Wks., Inc., 349 Belmont Ave., Brooklyn, N. Y.

Bender Warrick Corp., 131 Pierce, Birmingham, Mich.

Bendix Aviation Corp., Philadelpha Div., Philadelphia, Pa.

Benjamin Air Rifle Co., 1527 S. 8th St., St. Louis, Mo.

Benjamin Electric Mfg. Co., Des Plaines, Ill.

Bennett Co., 1109 Harney St., Omaha, Nebr.

Benson Co., Inc., Alex R., 1040 Bay Rd., So. Hudson, N. Y.

Berger Bros. Co., 229-237 Arch St., Philadelphia, Pa.

Berger Mfg. Div., Republic Steel Corp., 1038 Belden Ave., Canton, O.

Berns Specialty Co., 1015 Lake St., Chicago, Ill.

Bernz Co., Inc., Otto, 280 Lyell Ave., Rochester, N. Y.

Berry, Jr., & Co., Inc., F. E., Everett, Mass.

Bertsch & Co., Inc., Church St., Cambridge City, Ind.

Best Register Co., 2005 W. Oklahoma Ave., Milwaukee, Wis.

Bethlehem Foundry & Machine Co., W. Second St., Bethlehem, Pa.

Bethlehem Steel Co., Bethlehem, Pa.

Betz Air Conditioning Corp., 1820 Wyandotte St., Kansas City, Mo.

Betz Corp., 460 State St., Hammond, Ind.

Beverly Throatless Shear Co., 3009 W. 110th Pl., Chicago, Ill.

Bien Air Conditioning Co., Bell, Calif.

Bigelow Co., 92 River St., New Haven, Conn.

Biggs Boiler Wks. Co., Case Ave. & B. & O. R. R., E. Akron, O.

Bignall & Keeler Machine Wks., Edwardsville, Ill.

Billings & Spencer Co., 1 Laurel St., Hartford, Conn.

Binkley Mfg. Co., Warrenton, Mo.

●Binks Mfg. Co., 3114-40 Carroll Ave., Chicago, Ill.

Bird-Archer Co., 4337 North America St., Philadelphia, Pa.

●Bishop & Babcock Mfg. Co., 4901 Hamilton Ave., Cleveland, O.

Black & Decker Mfg. Co., Pennsylvania Ave., Towson, Md.

Black Magic Products Co., P. O. Box 1703, Tulsa, Okla.

Blackhawk Mfg. Co., 5325 W. Rogers St., Milwaukee, Wis.

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Blackmer Pump Co., 1809A Century Ave., S. W., Grand Rapids, Mich.
Blaisdell Compressor Co., 227 Fulton St., New York, N. Y.
Bliss Co., E. W., 1420 Hastings St., Toledo, O.
Blocksom & Co., E. 5th St., Michigan City, Ind.
Blood Brothers, Allegan, Mich.
Blower Application Co., 918 N. Fourth St., Milwaukee, Wis.
Blue Seal Chemical Co., 177 Westfield Ave., W., Roselle Park, N. J.
Bluffton Mfg. Co., The, 433 W. Main Cross St., Findlay, O.
Bodine Electric Co., 2254 W. Ohio St., Chicago, Ill.
Boester, Carl F., 101 E. Essex—Kirkwood, St. Louis, Mo.
Bogue Electric Co., 80 Glover Ave., Paterson, N. J.
Bohn Aluminum & Brass Corp., 2306 Franklin St., Detroit, Mich.
Boiler Room Equipment, Inc., 45 W. 45th St., New York, N. Y.
Bonney Forge & Tool Wks., Tilghman St. & Meadow St., Allentown, Pa.
Bordo Co., Inc., L. J., 115 New St., Glenside, Pa.
Borm Mfg. Co., Elgin, Ill.
Boston Auto Gage Co., 70 West St., Pittsfield, Mass.
Boston Gear Works, Inc., North Quincy, Mass.
Boston Woven Hose & Rubber Co., 29 Hampshire St., Cambridge, Mass.
Bostwick-Goodell Co., Norwalk, O.
Botfield Refractories Co., Swanson & Clymer Sts., Philadelphia, Pa.
Bowser & Co., Inc., S. F., 1302 E. Creighton Ave., Fort Wayne, Ind.
Boylston Steam Specialty Co., 116-122 W. Illinois St., Chicago, Ill.
Brasco Mfg. Co., Harvey, Ill.
Brauer Supply Co., A. G., 2100 Washington Ave., St. Louis, Mo.
Breidert Co., G. C., 3328 S. Central Ave., Los Angeles, Cal.
Bremil Mfg. Co., Box 1030, Erie, Pa.
Bridgeport Brass Co., 30 Grand St., Bridgeport, Conn.
Bridgeport Thermostat Co., Inc., Connecticut Ave., Bridgeport, Conn.
Briggs & Stratton Co., 2711 N. 13th St., Milwaukee, Wis.
Bristol Co., The, Waterbury, Conn.
Brooke Engineering Co., Inc., 4517 Wayne Ave., Philadelphia, Pa.
Brooks Equipment Corp., 90 West Ave., New York, N. Y.
Bros Boiler & Mfg. Co., Wm., Nicollet Island, Minneapolis, Minn.
Brown-Brockmeyer Co., Inc., 1098 Smithville Rd., Dayton, O.
Brown Fintube Co., The, Elyria, O.
Brown-Ford Corp., Newton, Mass.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., 4534 Wayne Ave., Philadelphia, Pa.
Brownell Co., 300 N. Findlay St., Dayton, O.
Browning Mfg. Co., Inc., 1940 Browning Blvd., Maysville, Ky.
Brundage Co., The, 500-514 N. Park St., Kalamazoo, Mich.
Bruning Co., Inc., Charles, 42-33 Ninth St., Long Island City, N. Y.
Brunner Mfg. Co., 1821 E. Broad St., Utica, N. Y.
Bryan Steam Corp., P. O. Box 337, Peru, Ind.
●Bryant Heater Co., The, 17825 St. Clair Ave., Cleveland, O.
Bubar, Hudson H., 15 Park Row, New York, N. Y.
Buckeye Products Co., 7024 Vine St., Cincinnati, O.
Buda Co., Harvey, Ill.
●Buffalo Forge Co., 171 Mortimer St., Buffalo, N. Y.
Buffalo Meter Co., 2917 Main St., Buffalo, N. Y.
●Buffalo Pumps, Inc., 171 Mortimer St., Buffalo, N. Y.
Buffalo Tank Co., Arlington, Staten Island, N. Y.
Builders-Providence, Inc., Div. of Puilders Iron Foundry, 9 Codding St., Providence, R. I.
●Bullard Co., The, 286 Canfield Ave., Bridgeport, Conn.
Bundy Steam Trap Co., Nashua, N. H.
Bundy Tubing Co., 10951 Hern, Detroit, Mich.
Burdett Mfg. Co., 19 N. Loomis St., Chicago, Ill.
Burhorn Co., Edwin, 554 W. 48th St., New York, N. Y.
Burke Electric Co., 1201 W. 12th St., Erie, Pa.
Burke Stoker & Mfg. Co., 921 W. 19th St., Chicago, Ill.
Burling Instrument Co., Air Conditioning Div., 253 Springfield Ave., Newark, N. J.
●Burnham Boiler Corp., Main St., Irvington, N. Y.
Burnham Stoker Co., 505 Columbia St., Vancouver, Wash.
Burnley Battery & Mfg. Co., Clay St., North East, Pa.
Burrows Mfg. Co., F. A., 318 E. Poplar St., York, Pa.
Burt Mfg. Co., 635 Main St., Akron, O.
Bury Compressor Co., 18th & Cascade Sts., Erie, Pa.
●Bush Mfg. Co., 100 Wellington St., Hartford, Conn.
Butler Street Foundry & Iron Co., 3422 Normal Ave., Chicago, Ill.
Butterworth, B. T., Jr., New Canaan, Conn.
●Byers Co., A. M., Clark Bldg., Pittsburgh, Pa.
Byron Jackson Co., P. O. Box 2017, Terminal Annex, Los Angeles, Cal.

C

Cabot, Inc., Samuel, 141 Milk St., Boston, Mass.
Calbar Paint & Varnish Co., 2612-26 N. Martha St., Philadelphia, Pa.
Caldwell Co., W. E., 2120 Brook St., Louisville, Ky.
California Cornice, Steel & Supply Corp., 1620 N. Spring St., Los Angeles, Cal.
Callahan Can Machine Co., Inc., 80 Richard St., Brooklyn, N. Y.
Calorider Corp., 50 E. 41st St., New York, N. Y.
Caloroil Burner Corp., 1477 Park St., Hartford, Conn.
Campbell Heating Co., E. K., 2445 Charlotte St., Kansas City, Mo.
Campbell Heating Co., 31st & Dean, Des Moines, Ia.
Canatsey Electric Mfg. Co., 620 Wyandotte St., Kansas City, Mo.
Cannon Chemical Co., 210 Broadway, Everett, Mass.
Canton Stoker Corp., 407 Andrew Place, S. W., Canton, O.
Canvas Products Co., 1236 S. 7th St., St. Louis, Mo.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., 2306 Franklin St., Detroit, Mich.
Carbide and Carbon Chemicals Corp., 30 E. 42nd St., New York, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carey Mfg. Co., Philip, Wayne Ave., Lockland, Cincinnati, O.
Carling Turbine Blower Co., 25 St. John's Rd., Worcester, Mass.
Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh, Pa.
Carnes, Inc., John R., Greenlawn Ave. & Erie R. R., Lima, O.
Carney Rockwool Co., Mankato, Minn.
Carpenter & Co., Geo. B., 440 N. Wells St., Chicago, Ill.
Carpenter & Paterson, Inc., 1190 Bennington St., East Boston, Mass.
Carpenter Steel Co., Reading, Pa.
Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.
Carty & Moore Engineering Co., 511 W. Larned St., Detroit, Mich.
Case & Son Mfg. Co., W. A., 33 Main St., Buffalo, N. Y.
●Cash Co., A. W., P. O. Box 135, Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Cashin Co., W. D., 69 A St., Boston, Mass.
Caterpillar Tractor Co., 600 W. Washington St., Peoria, Ill.
Cellufoam Products Div., Masonite Corp., 6565 S. Lavergne Ave., Chicago, Ill.
Celotex Corp., The, 919 N. Michigan Ave., Chicago, Ill.
Central Brass Mfg. Co., 2950 E. 55th St., Cleveland, O.
Central Die Casting & Mfg. Co., Inc., 2935 W. 47th St., Chicago, Ill.
Central Forging Co., Catawissa, Pa.
Central Foundry Co., 386 Fourth Ave., New York, N. Y.
Central Station Steam Co., 2920 E. Woodbridge St., Detroit, Mich.
Central Valve Mfg. Co., 255 E. 95th St., Chicago, Ill.
Central Wire & Iron Works, 621 E. Locust St., Des Moines, Ia.
Centrifix Corp., 3029 Prospect Ave., Cleveland, O.
●Century Electric Co., 1806 Pine St., St. Louis, Mo.
Century Engineering Corp., 401-431 3rd St., S. E., Cedar Rapids, Ia.
Century Fan & Ventilator Co., 292 Locust Ave., New York, N. Y.
Certain-teed Products Corp., 100 E. 42nd St., New York, N. Y.
Certified Flexible Couplings, Inc., 122 E. 42nd St., New York, N. Y.
Certified Products Co., 2014 N. 14th St., Toledo, O.
Chace Co., W. M., 1606 Beard Ave., Detroit, Mich.
Chain Belt Co., 1617 W. Bruce, Milwaukee, Wis.
Chain Tape Venetian Blind Co., Rockford, Ill.
Chalmers Oil Burner Co., 318 1st Ave., N., Minneapolis, Minn.
Chamberlin Metal Weather Strip Co., 1254 La Brosse St., Detroit, Mich.
Champion Blower & Forge Co., Harrisburg Ave. and Charlotte St., Lancaster, Pa.
Champion Furnace Pipe Co., 918 S. Adams St., Peoria, Ill.
Champion Machine & Forging Co., 3678 E. 78th St., Cleveland, O.
Champion Unit Heater Co., 4639-41 Washington Blvd., Chicago, Ill.
Chandler Co., 804 First Ave., N. W., Cedar Rapids, Ia.
Chaplin-Fulton Mfg. Co., 28-40 Penn Ave., Pittsburgh, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Char-Gale Mfg. Co., 3127 Hiawatha Ave., Minneapolis, Minn.
Chase Brass & Copper Co., 236 Grand St., Waterbury, Conn.
Chelsea Fan & Blower Co., 1206 S. Grove St., Irvington, N. J.
Chelsea Metal Stamping Co., 95 8th Ave., New York, N. Y.
Cheney Co., Ardmore, Pa.
Chesapeake & Ohio R.R. Co., Terminal Tower, Cleveland, O.
Chicago Belting Co., 113-125 N. Green St., Chicago, Ill.
Chicago Bridge & Iron Co., 332 S. Michigan Ave., Chicago, Ill.
Chicago Die Casting Mfg. Co., 2515 W. Monroe St., Chicago, Ill.
Chicago Expansion Bolt Co., 2240 W. Ogden Ave., Chicago, Ill.
Chicago Filter Co., Joliet, Ill.
Chicago Fire Brick Co., 1467 N. Elston Ave., Chicago, Ill.
Chicago Furnace Supply Co., 1278 Clybourn Ave., Chicago, Ill.
Chicago Metal Hose Corp., Maywood, Ill.
Chicago Metal Mfg. Co., 3724 S. Rockwell St., Chicago, Ill.
Chicago Nipple Mfg. Co., 1966 Southport Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Chicago Pump Co., 2323 Wolfram St., Chicago, Ill.
Chicago Specialty Mfg. Co., 332 N. Western Ave., Chicago, Ill.
Chicago Steel & Wire Co., 103rd St. and Torrence Ave., Chicago, Ill.
Chicago Venetian Blind Co., 3917 S. Michigan Ave., Chicago, Ill.
Chicago-Wilcox Mfg. Co., E. 77th St. and Anthony Ave., Chicago, Ill.
Chisholm Co., Allen E., 2640 E. Burnside St., Portland, Ore.
Cincinnati Electrical Tool Co., The, 2684 Madison Rd., Cincinnati, O.

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Cincinnati Shaper Co., Hopple, Garrard & Elam, Cincinnati, O.
Cincinnati Sheet Metal & Roofing Co., 230 E. Front St., Cincinnati, O.
Circulators & Devices Mfg. Corp., 100 Prince St., New York, N. Y.
Cissell Mfg. Co., W. M., 831 S. First St., Louisville, Ky.
●Clarage Fan Co., Porter St., Kalamazoo, Mich.
Clark Bros. Bolt Co., Milldale, Conn.
Clark Controller Co., 1146 E. 152nd St., Cleveland, O.
Clark Cooper Co., 159 Jefferson St., Philadelphia, Pa.
Clark Dust Control Co., 210 N. Mozart St., Chicago, Ill.
Clark Jr., Electric Co., Jas., 600 Bergman St., Louisville, Ky.
Clauss Shear Co., Fremont, O.
Clay Equipment Corp., Cedar Falls, Ia.
Clayton & Lambert Mfg. Co., 11111 French Rd., Detroit, Mich.
Cleaver-Brooks Co., 5100 N. 33rd St., Milwaukee, Wis.
Clees Valve & Engineering Co., 140 Cedar St., New York, N. Y.
Cleghorn Co., 86 Broad St., Boston, Mass.
Cleveland Punch & Shear Works Co., E. 40th and St. Clair Ave., Cleveland, O.
●Clifford Mfg. Co., 564 E. First St., Boston, Mass.
Clinton Metallic Paint Co., P. O. Box 278, Clinton, N. Y.
Clizbe Bros. Mfg. Co., Plymouth, Ind.
Clow & Sons, James B., 201-299 N. Talmon Ave., Chicago, Ill.
●Cochrane Corp., 3161 N. 17th St., Philadelphia Pa.
Coe Mfg. Co., Bank St., Painesville, O.
Cohoes Rolling Mill Co., Canvass and Cortland Sts., Cohoes, N. Y.
●Cole-Sullivan Engineering Co., 1316 Third St., N. Minneapolis, Minn.
Colebrook & Sons, Inc., W. H., 246 Walton St., Syracuse, N. Y.
Colonial Alloys Co., Metals Div., E. Somerset, Trenton Ave. and Reading R. R., Philadelphia, Pa.
Columbia Mills, Inc., Saginaw, Mich.
Columbia Radiator Co., 3400 Walnut St., McKeesport. Pa.
Columbia Steel Co. (Sub. United States Steel Corp.), Russ Bldg., 235 Montgomery St., San Francisco, Cal.
Columbian Steel Tank Co., 1509 W. 12th St., Kansas City, Mo.
Columbus Heating & Ventilating Co., 182 N. Yale Ave., Columbus, O.
Columbus Metal Products, Inc., 767 N. 4th St., Columbus, O.
Columbus Steam Pump Wks. Co., 724 W. Gay St., Columbus, O.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., 200 Madison Ave., New York, N. Y.
Comfort Products Corp., 7 W. 117th St., Harvey, Ill.
●Commercial Shearing & Stamping Co., 1775 Logan, Youngstown, O.
Commodore Heaters Corp., 11 W. 42nd St., New York, N. Y.
Commonwealth Brass Corp., 5781-5835 Commonwealth Ave., Detroit, Mich.
Commonwealth Electric Welder Mfg. Co., 3200-F W. Oxford St., Philadelphia, Pa.
Conditionaire Unit Co., 2821 Montrose Ave., Chicago, Ill.
Congress Die Casting Div., Congress Tool & Die Co., 3750 E. Outer Drive, Detroit, Mich.
Conklin Brass & Copper Co., Inc., T. E., 54-60 Laayette St., New York, N. Y.
Conneaut Packing Co., Conneaut, O.
Connery Construction Co., 2nd and Luzerne Sts., Philadelphia, Pa.
●Connor Engineering Corp., W. B., Dorex Div., 114 E. 32nd St., New York, N. Y.
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Consolidated Safety Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Continental Diamond Fibre Co., Newark, Del.
Continental Electric Co., Inc., 323 Ferry St., Newark, N. J.
●Continental Motors Corp., Muskegon, Mich.
Continental Products Co., 1150 E. 222nd St., Euclid, O.
Continental Rubber Wks., 1905 Liberty Blvd., Erie, Pa.
Continental Steel Corp., 1108 S. Main St., Kokomo, Ind.
Continental Stove Corp., Front and Walnut Sts., Ironton, O.
Cook, Inc., A. D., Lawrenceburg, Ind.
Cook Electric Co., 2700 Southport Ave., Chicago, Ill.
Coolmaster Corp., 530 S. Dearborn St., Chicago, Ill.
Cooper-Bessemer Corp., The, 200 Thomas Ave., Mt. Vernon, O.
Cooper Co., Clark. 159 Jefferson St., Philadelphia. Pa.
Cooper Sanitary Co., 3601 Ludlow St., Philadelphia, Pa.
Copeland Refrigeration Corp., Sidney, O.
Coppus Engineering Corp., 374 Park Ave., Worcester, Mass.
Corbman Bros., Inc., 1205 N. Fourth St., Philadelphia, Pa.
Cork Import Corp., 330 W. 42nd St., New York, N. Y.
Cork Insulation Co., Inc., 155 E. 44th St., New York, N. Y.
Corley Co., 629 Grove St., Jersey City, N. J.
Corning Glass Works, Corning, N. Y.
Coroaire Heater Corp., The, 1124 Hanna Bldg., Cleveland, O.
Cramer Co., Inc., R. W., The, Centerbrook, Conn.
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Crane Packing Co., 1801 Belle Plaine Ave., Chicago, Ill.
Crawford Co., 3220 W. 31st St., Chicago, Ill.
Crescent Tool Co., 230 Harrison St., Jamestown, N. Y.
Crise Elec. Mfg. Co., 2040 E. Main, Columbus, O.
Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.
Croll-Reynolds Engineering Co., Inc., 17 Johns St., New York, N. Y.
Croll & Son, Jesse G., 2326-2606 Germantown Ave., Philadelphia, Pa.
Cross Engineering Co., 160-178 Dundaff St., Carbondale, Pa.
Crown Die & Tool Co., 267 N. California Ave., Chicago, Ill.
Crown Iron Works, 1229 N. E. Tyler, Minneapolis, Minn.
Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y.
Cryer Trap & Valve Co., Inc., 366 Madison Ave., New York, N. Y.
Cugley Incubator Co., Elkhart, Ind.
Cuno Engineering Corp., 80 S. Vine St., Meriden, Conn.
Curtis & Curtis Co., 450 Garden St., Bridgeport, Conn.
●Curtis Refrigerating Machine Co., 1950 Kienlen Ave., St. Louis, Mo.
Cutler-Hammer, Inc., 315 N. 12th St. Milwaukee, Wis.
Cyrus Shank Co., 625 W. Jackson Blvd., Chicago, Ill.

D

D & M Mfg. Co., 51 Lincoln Ave., Midland Park, N. J.
Dallas Engineering Co., Inc., 2000 S. Akard, Dallas, Tex.
Dampney Co. of America, 1243 River St., Hyde Park, Boston, Mass.
Darcoid Co., Inc., 145 Sixth Ave., New York, N. Y.
Darling Valve & Mfg. Co., 701 First St., Williamsport, Pa.
●Dart Mfg. Co., E. M., 134 Thurbers Ave., Providence, R. I.
Davey Compressor Co., Kent, O.
Davidson Co., M. T., 154 Nassau St., New York, N. Y.
Davidson Hy Duty Roof Fan Co., 213 California St., Newton, Mass.
Davies Air Filter Corp., 118-120 E. 25th St., New York, N. Y.
Davis Engineering Corp., 1064 E. Grand St., Elizabeth, N. J.
Davis Regulator Co., 2546 S. Washtenaw Ave., Chicago. Ill.
Davison Chemical Corp., The, 20 Hopkins Place, Baltimore, Md.
●Day Co., The, 2938 Pillsbury Ave., Minneapolis, Minn.
Dayton Air Compressor Co., Dayton, O.
Dayton-Dowd Co., 115-17 York St., Quincy, Ill.
Dayton Rubber Mfg. Co., 2345 W. Riverview Ave., Dayton, O.
●Dean Bros. Co., 323 W. 10th St., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Dearborn Chemical Co., 310 S. Michigan Ave., Chicago, Ill.
Debevoise Co., The, 968 Grand St., Brooklyn, N. Y.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., East Moline, Ill.
Decatur Iron & Steel Co., Decatur, Ala.
Decatur Pump Co., 2750 Nelson Park Rd., Decatur, Ill.
Defender Automatic Regulator Co., 308 S. 8th St., St. Louis, Mo.
De Laval Steam Turbine Co., 300 Nottingham Way, Trenton, N. J.
De La Vergne Engine Co., Philadelphia, Pa.
Delco Appliance Co., Rochester, N. Y.
Delco Products Corp., 329 E. First St., Dayton, O.
Delta Stoker Co., Foot of Commonwealth, North Chicago, Ill.
Delta-Star Electric Co., 2400 Block, W. Fulton St., Chicago, Ill.
Deming Co., 14 Aetna St., Salem. O.
Demuth & Sons ,Charles, P. O. Box 74, New Hyde Park, Garden City Park, L. I.
Desmond-Stephan Mfg. Co., Urbana, Ill.
Desolvo Co., The, 31 Terminal Way, Pittsburgh, Pa.
Despatch Oven Co., 600 Ninth St., S. E., Minneapolis, Minn.
Detroit Air Meter Co., Box 1473, Detroit, Mich.
Detroit Brass & Malleable Works, 100 S. Campbell, Detroit, Mich.
Detroit Graphite Co., 550 12th St., Detroit, Mich.
●Detroit Lubricator Co., 5900 Trumbull Ave., Detroit, Mich.
Detroit Seamless Steel Tubes Co., c/o Grand River Station, Detroit, Mich.
●Detroit Stamping Co., 350 Midland Ave., Detroit, Mich.
Detroit Steel Products Co., 2250 E. Grand Blvd., Detroit, Mich.
Detroit Stoker Co., Sales and Engineering Offices, General Motors Bldg., Detroit, Mich.; Works at Monroe, Mich.
Detroit Stoker Co. of Canada, Ltd., Canada Bldg., Windsor, Ont.; Works at London, Ont.
DeVilbiss Co., The, 300 Phillips Ave., Toledo, O.
Devine Mfg. Co., Inc., J. P., 909 Shawnee Ave., Mt. Vernon, Ill.
Devlin Mfg. Co., Inc., Thomas, Burlington, N. J.
Dial Light Co. of America, Inc., 92 West St., New York, N. Y.
Diamond Chain & Mfg. Co., 400 Kentucky Ave., Indianapolis, Ind.
Diamond Chemical Products, 12 E. 41st St., New York, N. Y.
Diamond Expansion Bolt Co., Inc., 500 North Ave., Garwood, N. J.
Diamond Mfg. Co., 253 W. Eighth St., Wyoming, Pa.
Diamond Metal Weather Strip Co., 650 N. Fourth St., Columbus, O.
Diamond Power Specialty Corp., 10340 Oakland, Detroit, Mich.
Diceler Corp., The, Greenville, Pa.
Dick Co., Inc., R. & J., 24-48 Sade St., Passaic, N. J.
Diehl Mfg. Co., Trumbull St., Elizabethport, N. J.
Dillon Co., 220-C E. Brady St., Tulsa, Okla.
Dillon Steam Boiler Wks., Inc., D. M., Crocker St., Fitchburg, Mass.
Dissolene Corp., Hempstead, N. Y.
Dixon Crucible Co., Joseph, Wayne & Monmouth Sts., Jersey City, N. J.
Dockson Corp., 3847 Wabash Ave., Detroit, Mich.
Dockstader, S. E., 1128 Munsey Bldg., Washington, D. C.
Dodge Mfg. Corp., 500 S. Union St., Mishawaka, Ind.
Doheny Co., John J., 326 Lake St., Belmont, Mass.

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Dole Valve Co., The, 1901-41 Carroll Ave., Chicago, Ill.
Domestic Engine & Pump Co., Shippensburg, Pa.
Dow Chemical Co., Midland, Mich.
●Downingtown Iron Wks., Wallace Ave., Downingtown, Pa.
Downs-Smith Brass & Copper Co., 304-320 E. 45th St., New York, N. Y.
Dracco Corp., 4057 E. 116th St., Cleveland, O.
Dragert Co., Inc., C. H., 237 India St., Brooklyn, N. Y.
Dravo Corp., Dravo Bldg., Pittsburgh, Pa.
Drayer & Hanson, Inc., 738 E. Pico Blvd., Los Angeles, Cal.
Dreis & Krump Mfg. Co., 7404 Loomis Blvd., Chicago, Ill.
Dresser Mfg. Co., 490 Fisher Ave., Bradford, Pa.
Dry-Zero Corp., Merchandise Mart, Chicago, Ill.
Dual Air Fan Co., 711 W. Lake St., Chicago, Ill.
●Dunham Co., C. A., 450 E. Ohio St., Chicago, Ill.
Dunn, Inc., Struthers, 1332 Cherry St., Philadelphia, Pa.
du Pont de Nemours & Co., Inc., E. I., Fabrics & Finishes Dept., Wilmington, Del.
du Pont de Nemours & Co., Inc., E. I., The, R. & H. Chemicals Dept., Wilmington, Del.
du Pont de Nemours & Co., E. I., National Ammonia Div., Frankford, Philadelphia, Pa.
Durabla Mfg. Co., 114 Liberty St., New York, N. Y.
Durakool, Inc., 1010 N. Main St., Elkhart, Ind.
Duraloy Co., Scottdale, Pa.
Duriron Co., Inc., 450 N. Findlay St., Dayton, O.
Duro Co., 537 Monument Ave., Dayton, O.
Dustlix Corp., 715 N. Van Buren St., Milwaukee, Wis.
Dwyer Mfg. Co., F. W., 565 W. Washington Blvd., Chicago, Ill.
Dyer Welder & Engineering Co., 7 E. 19th St., Kansas City, Mo.

E

Eagle-Picher Lead Co., Temple Bar Bldg., Cincinnati, O.
Eastern Engineering Co., 45 Fox St., New Haven, Conn.
Eastern Foundry Co., Boyertown, Pa.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Eastern Oil & Equipment Co., Inc., 133 Marginal Way, Portland, Me.
Eastman Kodak Co., Kodak Park, Rochester, N. Y.
Eclipse Fuel Engineering Co., 707 S. Main St., Rockford, Ill.
Econocol Stoker Div. of Cotta Transmission Corp., 2340 11th St., Rockford, Ill.
Economy Electric Mfg. Co., 4606 W. 21st Pl., Chicago, Ill.
Economy Equipment Co., 223 N. Wolcott Ave., Chicago, Ill.
Economy Pumps, Inc., 1000 Weller Ave., Hamilton, O.
Eddy Stoker Corp., 4717 W. North Ave., Chicago, Ill.
Eddy Valve Co., Waterford, N. Y.
Edge Moor Iron Wks., Inc., 30 Rockefeller Plaza, New York, N. Y.
Edison, Inc., Thomas A., Edison Electrical Controls Div., Lakeside Ave., West Orange, N. J.
Edward Valve & Mfg. Co., Inc., 1200 W. 145th St., East Chicago, Ind.
Edwards Mfg. Co., Inc., 337 Eggleston Ave., Cincinnati, O.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Eiker Mfg. Co., Ogallala, Nebr.
Eisler Engineering Corp., 754 S. 13th St., Newark, N. J.
Elastic Stop Nut Corp., 2330 Vauxhall Rd., Union, N. J.
Electric Air Heater Co., Division of American Foundry Equipment Co., 619 S. Byrkit St., Mishawaka, Ind.
Electric Arc, Inc., 152 Jelliff Ave., Newark, N. J.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., Caledonia & Gillette Sts., La Crosse, Wis.
Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, O.
Electric Machinery Mfg. Co., 1331 Tyler St., N. E., Minneapolis, Minn.
Electric Valve Mfg. Co., Inc., 68 Murray St., New York, N. Y.
Electrimatic Corp., 2100 Indiana Ave., Chicago, Ill.
Electroaire Corp., 1455-57 W. Congress St., Chicago, Ill.
Electrogas Furnace Co., 2575 Bayshore Blvd., San Francisco, Cal.
Electrol, Inc., 934 Main Ave., Clifton, N. J.
Electrovent Fan & Mfg. Co., 812 W. Lake St., Chicago, Ill.
Elgin Softener Corp., Elgin, Ill.
Elgo Shutter & Mfg. Co., 6970 W. Jefferson Ave., Detroit, Mich.
Elliott Co., Jeannette, Pa.
Ellis Drier Co., 2444 N. Crawford Ave., Chicago, Ill.
Ellison Draft Gage Co., 214 W. Kinzie St., Chicago, Ill.
●Ellsworth Pipe & Supply Co., 1739 W. St. Paul Ave., Milwaukee, Wis.
Elsey Metal Specialties Co., 1535 Spruce St., Detroit, Mich.
Emerson Electric Mfg. Co., The, 1847 Washington Ave., St. Louis, Mo.
Empire Sheet & Tin Plate Co., N. Bowman St., Mansfield, O.
Empire Ventilation Equipment Co., 35-39 Vernon Blvd., Long Island City, N. Y.
Endura Mfg. Corp., 45 N. 4th St., Quakerstown, Pa.
Engelhard, Inc., Charles, 90 Chestnut St., Newark, N. J.
Engineer Co., 75 West St., New York, N. Y.
Enterprise Engine & Foundry Co., 2949 18th St., San Francisco, Cal.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Ergolyte Mfg. Co., 3644 Lawrence St., Philadelphia, Pa.
Erie Bolt & Nut Co., Erie, Pa.
Erie City Iron Wks., 1450 East Ave., Erie, Pa.
Erie Tool Wks., 11th & French Sts., Erie, Pa.
Esko Mfg. Corp., 3409 McKinney, Houston, Tex.
Essick Mfg. Co., 1950 Santa Fe Ave., Los Angeles, Cal.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Everlasting Valve Co., 49 Fisk St., Jersey City, N. J.
Excelsior Leather Washer Mfg. Co., 720-730 Chestnut St., Rockford, Ill.
Excelsior Steel Furnace Co., 118 So. Clinton St., Chicago, Ill.
Excelsior Tool & Machine Co., 31st & Ridge Ave., East St. Louis, Ill.

F

Fafnir Bearing Co., 37 Booth St., New Britain, Conn.
●Fairbanks Co., 396 Lafayette St., New York, N. Y.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Fairmont Aluminum Co., Fairmont, W. Va.
Fales Chemical Co., Inc., The, 545 Fifth Ave., New York, N. Y.
Falstrom Co., Main Ave. & D. L. & W. R. R., Passaic, N. J.
Faraday Engrg. Co., 56 Clearway St., Back Bay, Boston, Mass.
Farley Sleeve & Hanger Co., 3748 E. 71st St., Cleveland, O.
Farquhar Co., Ltd., A. B., Duke St., York, Pa.
Farrar & Trefts, 9 Grimes St., Buffalo, N. Y.
●Fedders Mfg. Co., Inc., 81 Tonawanda St., Buffalo, N. Y.
Federal Machine & Welder Co., 212 Dana St., Warren, O.
Federal-Mogul Corp., 11031 Shoemaker St., Detroit, Mich.
Fee & Mason Mfg. Co., Inc., 81 Beekman St., New York, N. Y.
Fee and Stemwedel, Inc., 2210 Wabansia Ave., Chicago, Ill.
Felt Products Mfg. Co., 1514 Carroll Ave., Chicago, Ill.
Felters Co., Inc., 210 South St., Boston, Mass.
Fergusen & Lange Foundry Co., 1039 Willow St., Chicago, Ill.
Fern, Ralph, 2430 Boulevard Ave., Scranton, Pa.
Ferro-Enamel Corp., 4150 E. 56th St., Cleveland, O.
Ferro-Nil Corp., 381 Fourth Ave., New York, N. Y.
Field Control Div., H. D. Conkey & Co., Mendota, Ill.
Filtrine Mfg. Co., Inc., 53 Lexington Ave., Brooklyn, N. Y.
Fingles, Inc., W. A., Reistertown Rd. at Elgin Ave., Baltimore, Md.
Fireline Stove & Furnace Lining Co., 1800 Kingsbury St., Chicago, Ill.
Firemood Machine Wks., Converse, Ind.
Firestone Tire & Rubber Co., S. Main St., Akron, O.
Fir-Tex Insulating Board Co., St. Helens, Ore.
●Fisher Governor Co., 205 S. First Ave., Marshalltown, Ia.
●Fitzgibbons Boiler Co., Inc., 101 Park Ave., New York N. Y.
Flagg & Co., Inc., Stanley G., 1421 Chestnut St., Philadelphia, Pa.
Flemm Lead Co., Inc., Bradley Ave. & School St., Long Island City, N. Y.
Flexitallic Gasket Co., 8th & Bailey Sts., Camden, N. J.
Flexlock Corp., 411 E. Market St., Akron, O.
Flexo Supply Co., Inc., 4221 Olive St., St. Louis, Mo.
Flintkote Co., 30 Rockefeller Plaza, New York, N. Y.
Flori Pipe Co., The, 601 E. Red Bud Ave., St. Louis, Mo.
Fluor Corp., Ltd., The, 2500 S. Atlantic Blvd., Los Angeles, Cal.
Flynn & Emrich Co., 301 Holliday St., Baltimore, Md.
Follansbee Steel Corp., 3rd & Liberty Aves., Pittsburgh, Pa.
Ford Roofing Products Co., 111 W. Washington St., Chicago, Ill.
Forman Air Conditioning & Engrg. Co., 345 W. 40th St., New York, N. Y.
Forslund Pump & Machinery Co., 1717-19 Main St., Kansas City, Mo.
Fossum, M. H., 2086 Marshall Ave., St. Paul, Minn.
Foster Engineering Co., 109 Monroe St., Newark, N. J.
Foster Pump Wks., Inc., 46-A Washington St., Brooklyn, N. Y.
Foster Wheeler Corp., 165 Broadway, New York, N. Y.
Fowler & Wolfe Radiator Co., Oak & Carson Sts., Norristown, Pa.
Fox Control & Mfg. Co., 3589 E. 93rd St., Cleveland, O.
Foxboro Co., 106 Neponset Ave., Foxboro, Mass.
France Packing Co., 6512 Tacony St., Tacony, Philadelphia, Pa.
Frank Heaters, Inc., 150 Railroad Ave., Paterson, N. J.
Frederick Iron & Steel Co., E. 7th St., Frederick, Md.
Fresh-'nd Air Co., 210 N. Clinton St., Chicago, Ill.
Fretz-Moon Tube Co., Inc., Butler, Pa.
●Frick Co., Waynesboro. Pa.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., 4 N. Central Ave., Baltimore, Md.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
Frost Mfg. Co., S. Henderson St., Galesburg, Ill.
Fuel Savers, Inc., 15th & Herr Sts., Harrisburg. Pa.
Fuelmiser Co., Inc., 938 Plymouth Bldg., Minneapolis, Minn.
Fulflo Specialties Co., Inc., The, Blanchester, O.
Fuller Co., 124 Bridge St., Catasauqua, Pa.
●Fulton Sylphon Co., The, Knoxville, Tenn.
Furblo Co., Hermansville, Mich.

G

G. D. S. Machinery & Supply Co., Inc., 101 Walker St., New York, N. Y.
G. M. Mfg. Co., 248 Lafayette St., New York, N. Y.
●G & O Mfg. Co., 138 Winchester Ave., New Haven, Conn.
Gale Products, Galesburg, Ill.
Gallaher Boiler Co., 3615 LaClede Ave., St. Louis, Mo.
Gallaher Co., Owatonna, Minn.
Garden City Fan Co., 332 S. Michigan Ave., Chicago, Ill.
Gardiner Metal Co., 2514 W. 48th Pl., Chicago, Ill.
Gardner-Denver Co., Quincy, Ill.
Garlock Packing Co., 50 Main St., Palmyra, N. Y.
Gasweld Equipment Co., 625 W. Jackson Blvd., Chicago, Ill.
Gates Rubber Co., 999 S. Broadway, Denver, Colo.

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Gatke Corp., 228 N. La Salle St., Chicago, Ill.
Gehl Bros. Mfg. Co., West Bend, Wis.
Gehri Co., 1117 Tacoma Ave., Tacoma, Wash.
General Air Conditioning Corp., 4411 Appleton St., Cincinnati, O.
General Aire Co., 118 N. Sixth St., Philadelphia, Pa.
General Blower Co., Inc., 5335 Market St., Philadelphia, Pa.
General Blower Corp., 1450 Army St., San Francisco, Cal.
General Ceramics Co., Keasbey, N. J.
●General Controls Co., 801 Allen Ave., Glendale, Cal.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., 5 Lawrence St., Bloomfield, N. J.
General Electric Co., Lamp Dept., Nela Park, Cleveland, O.
●General Electric Co., 1 River Rd., Schenectady, N. Y.
General Equipment Co., 315 S. Wichita, Wichita, Kans.
General Fittings Co., 123 Georgia Ave., Providence, R. I.
General Furnaces Corp., 90 Broad St., New York, N. Y.
General Gas Light Co., 212 N. Park, Kalamazoo, Mich.
General Insulating Products Co., 8821 15th Ave., Brooklyn, N. Y.
General Machinery Co., 3500 Riverside Ave., Spokane, Wash.
General Motors Corp., Detroit, Mich.
General Motors Corp., Moraine Products Div., Dayton, O.
General Plate Div., Metals & Controls Corp., 34 Forest St., Attleboro, Mass.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
General Sales & Products Co., 242 Saratoga St., Cohoes, N. Y.
Gerett Corp., M. A., 2947 N. 30th St., Milwaukee, Wis.
Gerstein & Cooper Co., 1 W. Third St., South Boston, Mass.
Geuder, Paeschke & Frey Co., W. St. Paul Ave. and N. 15th St., Milwaukee, Wis.
Giant Grip Mfg. Co., 30 Osceola St., Oshkosh, Wis.
Giant Mfg. Co., South Ave., Council Bluffs, Ia.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Gillian Mfg. Co., 7752 Dubois St., Detroit, Mich.
●Gilmer Company, L. H., 7230 Keystone St., Tacony, Philadelphia, Pa.
Glaser Lead Co., Inc., 31 Wyckoff Ave., Brooklyn, N. Y.
Gleason-Avery, Inc., 27 Clark St., Auburn, N. Y.
Glidden Co., 11001 Madison Ave., Cleveland, O.
Globe Machine & Stamping Co., 1220 W. 76th St., Cleveland, O.
Globe Steel Tubes Co., 3839 W. Burnham St., Milwaukee, Wis.
Glore Sales Corp., Evins F., 1939 Grand Central Terminal Bldg., New York, N. Y.
Goese Mfg. Co., 2548 N. 18th St., Milwaukee, Wis.
Goethel Co., Alfred C., 2337 N. 31st St., Milwaukee, Wis.
Goethel Sheet Metal Wks., Alfred, 1910 N. Killian Pl., Milwaukee, Wis.
Goetze Gasket & Packing Co., Inc., 60 Allen Ave., New Brunswick, N. J.
Golden-Anderson Valve Specialty Co., Fulton Bldg., Pittsburgh, Pa.
Goldens' Foundry & Machine Co., Columbus, Ga.
Goodrich Co., B. F., 548 S. Main St., Akron, O.
Goodyear Tire & Rubber Co., E. Market St., Akron, O.
Gorton Heating Corp., Cranford, N. J.
Goulds Pumps, Inc., Fall St., Seneca Falls, N. Y.
Governair Corp., 605 W. Main St., Oklahoma City, Okla.
Grabler Mfg. Co., 6565 Broadway, Cleveland, O.
Grand Rapids Blow Pipe & Dust Arrester Co., 525-28 Monroe Ave., Grand Rapids, Mich.
Grand Rapids Die & Tool Co., 113-117 Michigan St., Grand Rapids, Mich.
Granite City Steel Co., 20th & Madison Ave., Granite City, Ill.
●Grant Wilson, Inc., 4115 W. Taylor St., Chicago, Ill.
Graton & Knight Co., 356 Franklin St., Worcester, Mass.
Graver Tank & Mfg. Co., Inc., 4809 Todd Ave., East Chicago, Ind.
Gray Metal Products, Inc., Rochester, N. Y.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Great National Air Conditioning Corp., 1305-9 S. Lamar St., Dallas, Tex.
Green Fire Brick Co., A. P., Mexico, Mo.
Greene, Tweed & Co., 101 Park Ave., New York, N. Y.
Greenfield Tap & Die Corp., Sanderson St., Greenfield, Mass.
Greenlee Tool Co., Rockford, Ill.
Grief, Edward C., 64 West End Ave., Bogota, N. J.
●Grinnell Co., Inc., 260 W. Exchange, Providence, R. I.
Griscom-Russell Co., The, 285 Madison Ave., New York, N. Y.
Grobet File Corp. of America, 3 Park Pl., New York, N. Y.
Grove Regulator Co., 1729 Poplar St., Oakland, Cal.
Guardian Electric Mfg. Co., 1621 W. Walnut St., Chicago, Ill.
Guardian Utilities Co., 215 E. Michigan St., Michigan City, Ind.
Guild & Garrison, Inc., 43 Keap St., Brooklyn, N. Y.
Guth Co., Edwin F., 2615 Washington Blvd., St. Louis, Mo.
Gylstrom Co., O., 108 W. Wells St., Milwaukee, Wis.

H

H-B Instrument Co., 2518 N. Broad St., Philadelphia, Pa.
H. & B. Sales Co., Ltd., 2875 Cherry Ave., Long Beach, Cal.
Haering Co., Inc., D. W., 205 W. Wacker Dr., Chicago, Ill.
Hagan Corp., 600 Bowman Bldg., Pittsburgh, Pa.
Hague & Co., Inc., Alfred, 227 Thirty-fourth St., Brooklyn, N. Y.
●Haines & Co., William S., 12th & Buttonwood Sts., Philadelphia, Pa.
Hall Mfg. Co., Cedar Rapids, Ia.
Halowax Corp., 30 E. 42nd St., New York, N. Y.
Hamburg Boiler Wks., Inc., Grand St., Hamburg, Pa.
Hamilton Rubber Mfg. Co., Mead St., Trenton, N. J.
Hammett Mfg. Co., 209 W. 19th Ter., Kansas City, Mo.
Hammond Aircraft Corp., South San Francisco, Cal.
Hammond Brass Wks., Summer Blvd., Hammond, Mich.
Hampton-Cross Co., The, 1014 W. Main St., Louisville, Ky.
Hampton Electric Mfg. Co., Third and Archie Sts., Pittsburgh, Pa.
Hancock Valve Div., Manning, Maxwell & Moore Inc., 11 Elias St., Bridgeport, Conn.
Handley Brown Heater Co., Jackson, Mich.
Handy & Harman, 82 Fulton St., New York, N. Y.
Hanlon-Waters, Inc., National Bank of Tulsa Bldg., Tulsa, Okla.
Hardinge Mfg. & Oil Burner Co., 1770 Berteau St., Chicago, Ill.
Hardy, Inc., Charles, 415 Lexington Ave., New York, N. Y.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.
Harrington & King Perforating Co., 5655 Fillmore St., Chicago, Ill.
Harris, A. R., 4546 Hohman Ave., Hammond, Ind.
Harris Calorific Co., The, 5501 Cass Ave., N. W., Cleveland, O.
Harris & Co., Arthur, 210 N. Aberdeen St., Chicago, Ill.
Harrisburg Foundry & Machine Co., Inc., 7th & Curtin St., Harrisburg, Pa.
Harrisburg Steel Corp., 10th & Herr Sts., Harrisburg, Pa.
Harry Cooling Towers, Inc, 554 W. 48th St., New York, N. Y.
Hart & Cooley Mfg. Co., Holland, Mich.; Chicago office, 61 W. Kinzie St.
Hart Mfg. Co., Hamilton St., Hartford, Conn.
Hartmann Co., Chas., 985 Dean St., Brooklyn, N. Y.
Hartzell Propeller Fan Co., P. O. Box 909, Roosevelt Ave., Piqua, O.
Harvey-Whipple, Inc., Springfield, Mass.
Hasco Valve & Machine Co., 1819 W. St. Paul Ave., Milwaukee, Wis.
Haskell Mfg. Co., Wm. H., 20 Commerce St., Pawtucket, R. I.
Hastings Air Conditioning Co., Box 481, 108 S. Colorado Ave., Hastings, Nebr.
Haydn F. White & Co., 1740 E. 12th St., Cleveland, O.
●Hays Corp., E. 8th St., Michigan City, Ind.
Hays Mfg. Co., 801 W. 12th St., Erie, Pa.
Healy Ruff Co., 765 Hampden Ave., St. Paul, Minn.
Heartley Machine & Tool Co., 900-8 Summit Ave., Toledo, O.
Heat Transfer Products, Inc., 90 West St., New York, N. Y.
Heating Assurance, Inc., 124 E. Augusta St., Spokane, Wash.
Hegeler Zinc Co., P. O. Box 599, Danville, Ill.
Hendley & Whittemore, 6 Blackhawk Blvd., Beloit, Wis.
Hendrick Mfg. Co., 37 Dundaff St., Carbondale, Pa.
Henry Furnace & Foundry Co., 3480 E. 49th St., Cleveland, O.
Henry Valve Co., 1019 N. Spaulding Ave., Chicago, Ill.
Henry & Wright Mfg. Co., 760 Windsor St., Hartford, Conn.
Herbert Boiler Co., 2300 Bloomingdale Ave., Chicago, Ill.
Her-Born Engineering & Mfg. Co., 212 Columbus Ave., Sandusky, O.
Herbusch Corp., The, 706 Chestnut St., 210 Title Guaranty Bldg., St. Louis, Mo.
Hercules Chemical Co., Inc., 332 Canal St., New York, N. Y.
Hercules Float Wks., 200 Franklin St., Springfield, Mass.
Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.
Hess Warming & Ventilating Co., 1211 S. Western Ave., Chicago, Ill.
Hetzel Roofing Products Co., 67 Maine St., Newark, N. J.
Higgin Products, Inc., Newport, Ky.
Highside Chemicals Co., 195 Verona Ave., Newark, N. J.
Hill Diesel Engine Co., Lansing, Mich.
Hill, E. Vernon, 6826 W. Highland Ave., Chicago, Ill.
Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn, N. Y.
Hinde & Dauch Paper Co., Sandusky, O.
Hirschman Co., W. F., 1245 McKinley Parkway, Buffalo, N. Y.
Hobart Bros., Hobart Sq., Troy, O.
Hodge Boiler Wks., Summer St., East Boston, Mass.
Hodgman Mfg. Co., 135 Washington St., Taunton, Mass.
Hoffman Combustion Engineering Co., 710 Marquette Bldg., Detroit, Mich.
●Hoffman Specialty Co., Inc., 1001 York St., Indianapolis, Ind.
Holcomb & Hoke Mfg. Co., 1545 Van Buren, Indianapolis, Ind.
Hollands Mfg. Co., Erie, Pa.
Hollup Corp., Div. of National Cylinder Gas Co., 3357 W. 47th Pl., Chicago, Ill.
Holsclaw Bros., Inc., Evansville, Ind.
Holtum Mfg. Co., Freeport, Ill.
Holtzer-Cabot Electric Co., 125 Amory St., Boston, Mass.
Homestead Valve Mfg. Co., P. O. Box 348, Coraopolis, Pa.
Hoppes Mfg. Co., 850 N. Belmont Ave., Springfield, O.
Horn Co., A. C., 43-36 Tenth St., Long Island City, N. Y.
Horton Mfg. Co., 3016 University Ave., S. E., Minneapolis, Minn.
Hossfeld Mfg. Co., 460 W. Third St., Winona, Minn.
Hotstream Heater Co., 8007 Grand Ave., Cleveland, O.
Hough Shade Corp., Janesville, Wis.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Hound Packing Co., 4757 E. Ravenswood Ave., Chicago, Ill.
Howard Iron Wks. & Alberger Heater Co., 287 Chicago St., Buffalo, N. Y.
Howe Ice Machine Co., 2825 Montrose Ave., Chicago, Ill.
●Howell Electric Motors Co., Howell, Mich.

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Howes-Woods Co., 511 Medford St., Charlestown District, Boston, Mass.
Hubbell Corp., 1315 W. Carroll Ave., Chicago, Ill.
Hugo Mfg. Co., 49th Ave., W., & Superior St., West Duluth, Minn.
Hunt & Son, C. B., Salem, O.
Hunter Fan & Ventilating Co., Inc., 714 Sterick Bldg., Memphis, Tenn.
●Hussey & Co., C. G., 2850 Second Ave., Pittsburgh, Pa.
Huyette Co., Inc., Paul B., 401 N. Broad St., Philadelphia, Pa.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Hynes Electric Heating Co., West and Clinton Sts., Camden, N. J.

I

Ice Cooling Appliance Corp., Morrison, Ill.
Ideal Commutator Dresser Co., 1096 Park Ave., Sycamore, Ill.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, O.
●Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.
●Illinois Engineering Co., 2035 S. Racine Ave., Chicago, Ill.
Illinois Iron & Bolt Co., 918 S. Michigan Ave., Chicago, Ill.
Illinois Malleable Iron Co., 1801 Diversey Ave., Chicago, Ill.
Illinois Oil Co., 4th Ave. and 24th St., Rock Island, Ill.
●Illinois Testing Laboratories, 420 N. La Salle St., Chicago, Ill.
Illinois Zinc Co., 47th St. at Sacramento Ave., Chicago, Ill.
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
Imperial Electric Co., 64 Ira Ave., Akron, O.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
●Independent Register Co., 3747 E. 93rd St., Cleveland, O.
Indian Trailer Corp., Koolroom Div., 2338 Indiana Ave., Chicago, Ill.
Industrial Engineering Corp., Terre Haute, Ind.
Industrial Lock Nut Co., South Hanover, Mass.
Industrial Mfg. & Engineering Co., 3845 N. Ravenswood Ave., Chicago, Ill.
Industrial Research, Lansdowne, Pa.
Industrial Service Laboratories, 915 W. Oklahoma Ave., Milwaukee, Wis.
●Industrial Sheet Metal Wks., Inc., 628 E. Forest Ave., Detroit, Mich.
●Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Ingersoll-Rand, 11 Broadway, New York, N. Y.
Inland Mfg. Co., 1120 N. Cicero Ave., Chicago, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Inner-Tite Clamp Corp., 18 W. Jersey St., Elizabeth, N. J.
Insto-Gas Corp., 1900 E. Jefferson, Detroit, Mich.
Insulite Div. Minnesota and Ontario Paper Co., 1100 Builders Exchange Bldg., Minneapolis, Minn.
Insul-Wool Insulation Corp., Wichita, Kans.
Inter-Coastal Paint Corp., 15th St., and Southern R. R., East St. Louis, Ill.
International Boiler Works, East Stroudsburg, Pa.
International Correspondence Schools, Scranton, Pa.
International Engineering, Inc., 1145 Bolander Ave., Dayton, O.
International Engineering Wks., Inc., Box 71, Framingham, Mass.
●International Exposition Co., Grand Central Palace, New York, N. Y.
International Heater Co., 101 Park Ave., Utica, N. Y.
International Moistening Co., 489 S. Main St., Providence, R. I.
International Nickel Co., 67 Wall St., New York, N. Y.
International Nutyp Tool Co., 68 W. First St., Oswego, N. Y.
International Register Co., 2620 W. Washington Blvd., Chicago, Ill.
International Steel Co., 1545 Edgar St., Evansville, Ind.
International Vermiculite Co., 11th & Stanford Ave., Springfield, Ill.
Iona Ventilator Co., Inc., 2821-29 W. Dauphin St., Philadelphia, Pa.
Iowa Paint Mfg. Co., 118-20 Eighth St., Des Moines, Ia.
Iron Fireman Mfg. Co., 3170 W. 106 St., Cleveland, O.
Iwan Brothers, 1503 Prairie Ave., South Bend, Ind.

J

Jackson Co., Byron, P. O. Box 2017, Terminal Annex, Los Angeles, Cal.
Jackson & Church Co., 321 N. Hamilton Ave., Saginaw, Mich.
Jacobs Co., B. & J., 1729 John St., Cincinnati, O.
Jaden Mfg. Co., Inc., F., 1601 Second St., Hastings, Nebr.
Jamar Co., Walker, 367 S. First Ave., E. Duluth, Minn.
Jamieson Mfg. Co., 820 Eagle Ford Rd., Dallas, Tex.
Janette Mfg. Co., 556 W. Monroe St., Chicago, Ill.
Jarecki Mfg. Co., 1345 W. 12th St., Erie, Pa.
Jefferson Electric Co., 25th & Madison St., Bellwood, Ill.
Jefferson Union Co., Sales Office, 601 W. 26th St., New York, N. Y.; Factory, Lexington, Mass.
Jefferson Union Co., Inc., Lockport, N. Y.
Jeffrey Mfg. Co., 859-99 N. Fourth St., Columbus, O.
●Jenkins Bros., 80 White St., New York, N. Y.
Jennison Co., 17 Putnam St., Fitchburg, Mass.
Jessop Steel Co., Washington, Pa.
●Jewel Mfg. Co., 1841 University Ave., St. Paul, Minn.
Joal Mfg. Corp., 2058 Canton St., Toledo, O.
●Johns-Manville, 22 E. 40th St., New York, N. Y.
Johnson Bronze Co., 460 S. Mill St., New Castle, Pa.
Johnson Co., S. T., 940 Arlington St., Oakland, Cal.; 401 N. Broad St., Philadelphia, Pa.
Johnson Corp., 830 Wood St., Three Rivers, Mich.
Johnson Fan & Blower Corp., 1320 W. Lake St., Chicago, Ill.
Johnson Gas Appliance Co., 520 "E" Ave., N. W., Cedar Rapids, Ia.
Johnson Mfg. Co., 10th & Sycamore, Waterloo, Ia.
●Johnson Service Co., 507 E. Michigan St., Milwaukee, Wis.
Johnston Bros., Inc., Ferrysburg, Mich.
Johnston & Chapman Co., 2925 Carroll Ave., Chicago, Ill.
Johnston Co., William W., 115 Bayard St., Dayton, O.
Johnston & Jennings Co., 877 Addison Rd., Cleveland, O.
Johnston Tin Foil & Metal Co., 6100 S. Broadway, St. Louis, Mo.
Jones Foundry & Machine Co., W. A., 4401 Roosevelt Rd., Chicago, Ill.
Jones & Laughlin Steel Corp., Third & Ross St., Pittsburgh, Pa.
Jordan & Co., Paul R., 631 S. Delaware St., Indianapolis, Ind.
Justus Steam Trap Co., Napanoch, N. Y.

K

Kainer & Co., 761 W. Lexington, Chicago, Ill.
Kaiser Co., H. S., 3336 Franklin Blvd., Chicago, Ill.
Kane Mfg. Corp., Kane, Pa.
Kauffman Air Conditioning Corp., 4336 W. Pine Blvd., St. Louis, Mo.
Kaufman, H. J., 13215 Roselawn Ave., Detroit, Mich.
Kaye & MacDonald, Inc., 92 Franklin Ave., West Orange, N. J.
Keasbey Co., Robert A., 139-149 W. 19th St., New York, N. Y.
Keasbey & Mattison Co., Butler Ave., Ambler, Pa.
Keckley Co., O. C., 400 W. Madison St., Chicago, Ill.
Keeler Co., E., 238 West St., Williamsport, Pa.
Keeney Mfg. Co., Main St., Newington, Conn.
Kehm Corp., The, 441 N. La Salle St., Chicago, Ill.
Keldur Corp., 420 Lexington Ave., New York, N. Y.
Kellogg Co., M. W., The, 225 Broadway, New York, N. Y.
Kelly-Koet, Covington, Ky.
Kelvin-White Co., 90 State St., Boston, Mass.
Kelvinator Div., Nash-Kelvinator Corp., 14250 Plymouth Rd., Detroit, Mich.
Kennard, Inc., Sam, 3331-3339 Market St., St. Louis, Mo.
Kennedy, Inc., David E., 60 Second Ave., Brooklyn, N. Y.
Kennedy Valve Mfg. Co., The, Elmira, N. Y.
Kerentoff, G. L., 2803 Jefferson Ave., Cincinnati, O.
Kernchen Co., 103 E. Wacker Drive, Chicago, Ill.
Kerotest Mfg. Co., 2525 Liberty Ave., Pittsburgh, Pa.
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
●Kewanee Boiler Corp., Kewanee, Ill.
●Key Co., 2700 McCasland, East St. Louis, Ill.
Keystone Asphalt Products Co., 43 E. Ohio St., Chicago, Ill.
Keystone-Carbon Co., Inc., St. Marys, Pa.
Kidder Mfg. Co., Inc., J. F., 426 Colchester Ave., Burlington, Vt.
Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y.
Kimball-Krogh Pump Div., Food Machinery Corp., 301 West Ave. 26, Los Angeles, Cal.
Kimberly-Clark Corp., Neenah, Wis.
Kinetic Chemicals, Inc., 10th & Market St., Wilmington, Del.
King Engineering Corp., 942 Willard Ave., Ann Arbor, Mich.
King Union Co., Inc., Hillsgrove, R. I.
King Ventilating Co., Box 178, Owatonna, Minn.
Kingsford Foundry & Machine Wks., 264 W. Second St., Oswego, N. Y.
Kingston Products Corp., 1415 N. Webster, Kokomo, Ind.
Kinney Mfg. Co., 3529 Washington St., Boston, Mass.
Kirk & Blum Mfg. Co., 2838-52 Spring Grove Ave., Cincinnati, O.
Kisco Boiler & Engineering Co., 3732 Chouteau Ave., St. Louis, Mo.
Kisco Co., Inc., 39th and Chouteau Ave., St. Louis, Mo.
Klauer Mfg. Co., 9th and Washington Sts., Dubuque, Ia.
Klee Co., Geo. B., 1056-58 Hulbert Ave., Cincinnati, O.
Kleenaire Corp., 409 Jefferson St., Stevens Point, Wis.
Klingerit, Inc., 16-22 Hudson St., New York, N. Y.
Klipfel Mfg. Co., 2651 W. Harrison St., Chicago, Ill.
Kluegel & Co., E., 187 W. Kellogg Blvd., St. Paul, Minn.
Knickerbocker Co., Jackson, Mich.
Knight, Maurice A., Kelly Ave., Akron, O.
Knowles Mushroom Ventilator Co., 11 Label St., Montclair, N. J.
Kohler Co., Kohler, Wis.
Kol-Master Corp., Oregon, Ill.
Kopperman & Sons, Joseph, 316 New St., Philadelphia, Pa.
Koppers Co., Bartlett Haywood Div., 200 Scott St., Baltimore, Md.
Korfund Co., 48-15 32nd Pl., Long Island City, N. Y.
Koven & Bro., L. O., 154 Ogden Ave., Jersey City, N. J.
Kraissl Co., Inc., The, Terhune and Williams Aves., Hackensack N. J.
Kramer Trenton Co., 626 Brunswick Ave., Trenton, N. J.
Krehbiel Co., J. H., 425 N. Crawford Ave., Chicago, Ill.
Krez Co., Paul J., 444 N. LaSalle St., Chicago, Ill.
Kuhlman Electric Co., Detroit Electric Furnace Div., Bay City, Mich.
Kuhns Bros. Co., 1800 McCall St., Dayton, O.

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Kunkle Valve Co., 121 N. Clinton St., Ft. Wayne, Ind.
Kwikon Co, 626 W. Jackson Blvd., Chicago, Ill.

L

La Bour Co., Inc., The, 1301 Sterling Ave., Elkhart, Ind.
Laclede-Christy Clay Products Co., 411 N. Seventh St., St. Louis, Mo.
Laclede Steel Co., Arcade Bldg., Rm. 1317, St. Louis, Mo.
Laclede Stoker Co., 4438 Hunt Ave., St. Louis, Mo.
La Crosse Steel Roofing & Corrugating Co., 300 S. Third St., La Crosse, Wis.
La Crosse Tractor Co., La Crosse, Wis.
Lammert & Mann Co., 281 N. Wood St., Chicago, Ill.
Lamneck Products, Inc., Middletown, O.
Lamson & Sessions Co., 1971 W. 85th St., Cleveland, O.
Landis Machine Co., Inc., 5th & Church Sts., Waynesboro, Pa.
Larkin Coils, Inc., 519 Memorial Dr., S. E., Atlanta, Ga.
Larkin Packer Co., 6200 Maple Ave., St. Louis, Mo.
Lastik Products Co., Inc., 603 American Bank Bldg., Pittsburgh, Pa.
Lau Blower Co., 2001 Home Ave., Dayton, O.
Lawler Automatic Controls, Inc., 453 N. MacQuesten Pkwy., Mount Vernon, N. Y.
Lawrence Pump & Engine Co., P. O. Box 70, Lawrence, Mass.
Lawson Co., F. H., Evans & Whateley Sts., Cincinnati, O.
Layne & Bowler, Inc., Memphis, Tenn.
Lead Lined Iron Pipe Co., 1 Broadway, Wakefield, Mass.
Leavitt Machine Co., East River St., Orange, Mass.
Lecourtenay Co., 5 Maine St., Newark, N. J.
Lee Engineering Co., Union National Bank Bldg., Youngstown, O.
Lee & Son Co., K. O., Aberdeen, S. D.
Lee & Son Co., Thomas, 128-132 W. Second St., Cincinnati, O.
Leeds & Northrup Co., 4970 Stenton Ave., Philadelphia, Pa.
Leffel & Co., James, 426 East St., Springfield, O.
Lehigh Fan & Blower Co., Front & Linden Sts., Allentown, Pa.
Lehon Co., 4411 Oakley Ave., Chicago, Ill.
Leinweber Fan & Blower Co., 8448 Crandon, Chicago, Ill.
Leland Electric Co., 1501 Webster St., Dayton, O.
Lennox Furnace Co., Marshalltown, Ia., Syracuse, N. Y., and Columbus, O.
Leonard Valve Company, Elmwood Station, Providence, R. I.
Leslie Co., Valley Brook & Grant Aves., Lyndhurst, N. J.
Leslie Welding Co., 2943 Carroll Ave., Chicago, Ill.
Levow, David, 308 W. 20th St., New York, N. Y.
Lewellen Mfg. Co., Columbus, Ind.
●Lewin-Mathes Co., Lewin Metals Div., East St. Louis, Ill.
Lewis & Co., Inc., Chas. S., 2207 Pine St., St. Louis, Mo.
Leyman Mfg. Corp., John H. McGowan Co. Div., 954 Ellison Ave., Cincinnati, O.
Libbey-Owens-Ford Glass Co., Nicholas Bldg., Toledo, O.
Lilie-Hoffman Cooling Towers, Inc., 4239 Duncan Ave., St. Louis Mo.
Limbert & Co., Geo. B., 570 Fulton St., Chicago, Ill.
Lincoln Electric Co., 12818 Coit Rd., Cleveland, O.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Linear Packing & Rubber Co., Inc., N. W. Cor. State Rd. & Levick St., Philadelphia, Pa.
Link-Belt Co., 307 N. Michigan Ave., 300 W. Pershing Rd., and 2410 W. 18th St., Chicago, Ill.; 519 N. Holmes Ave., and 220 S. Belmont Ave., Indianapolis, Ind.; 2045 W. Hunting Park Ave., Philadelphia, Pa.
Lion Mfg. Corp., 2701-11 Belmont Ave., Chicago, Ill.
Liquid Carbonic Corp., 3100 S. Kedzie Ave., Chicago, Ill.
Liquidometer Corp., 37-15 Skillman Ave., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, 23-01 Borden Ave., Long Island City, N. Y.
Little Giant Vaporizer Co., 5101 Classen Blvd., Oklahoma City, Okla.
Little Mfg. Co., M. S., 151 New Park Ave., Hartford, Conn.
Littleford Bros., 421 E. Pearl St., Cincinnati, O.
Locke Regulator Co., 76 North St., Salem, Mass.
Lockformer Co., The, 4615 Arthington St., Chicago, Ill.
Lockjoint Wood Products Co., 1721 Mildred St., Wichita, Kans.
Locknut Corp. of America, 3403 W. 47th St., Chicago, Ill.
Logan Engineering Co., Lawrence & Lamon Ave., Chicago, Ill.
Logansport Radiator Equipment Co., Logansport, Ind.
Lohman Co., Wm. J., 1206 S. Grove St., Irvington, N. J.
Lonergan Co., J. E., 211 Race St., Philadelphia, Pa.
Long Mfg., Div. Borg-Warner Corp., 12501 Dequindre St., Detroit, Mich.
Lonn Mfg. Co., Inc., 500 N. Dearborn St., Chicago, Ill.
Lookout Boiler & Mfg. Co., Compress St. & Mfrs. Rd., Chattanooga, Tenn.
Lord Mfg. Co., 1633 W. 12th St., Erie, Pa.
Lovejoy Flexible Coupling Co., 5024 W. Lake St., Chicago, Ill.
Lowell Air Conditioning Corp., Otis Bldg., Philadelphia, Pa.
Lowell Wrench Co., 54 Commercial St., Worcester, Mass.
Loyal Knight Stokers, Inc., 800 Scheel St., Belleville, Ill.
Lucius, Wm. I., 522 W. 45th St., New York, N. Y.
Ludlow Valve Mfg. Co., Inc., Foot of Adams St., Troy, N. Y.
Lukens Steel Co., 308 S. First Ave., Coatesville, Pa.
Lumsden & Van Stone Co., 426 First St., South Boston, Mass.
Lunkenheimer Co., Waverly & Beekman Sts., Cincinnati, O.
Luzerne Rubber Co., Muirhead Ave., Trenton, N. J.
Lynchburg Foundry Co., Peoples Bank Bldg., Lynchburg, Va.
Lyon, Conklin & Co., Inc., McComas & Race Sts., Baltimore, Md.

M

Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J.
Macksons Co., 125 Cedar St., New York, N. Y.
MacLean-Fogg Lock Nut Co., 2653 N. Kildare, Chicago, Ill.
Magirl Foundry & Furnace Wks., P. H., 413 E. Oakland Ave., Bloomington, Ill.
Magnet Switch Co., 340 W. Huron St., Chicago, Ill.
Mahon Co., R. C., 8650 Mt. Elliott Ave., Detroit, Mich.
●Maid-O'-Mist, Inc., 215 N. Aberdeen St., Chicago, Ill.
Maintenance Engineering Corp., 3611 Clinton Dr., Houston, Tex.
Majestic Co., 733 Erie St., Huntington, Ind.
Major Controls Sales Div., 12 Norfolk St., Cambridge, Mass.
Mall Tool Co., 7740 S. Chicago Ave., Chicago, Ill.
●Malleable Iron Fittings Co., Branford, Conn.
Mallory Sales Co., 13904 Lincoln Ave., Dolton, Ill.
Manhattan Perforated Metal Co., Inc., 43-17 37th St., Long Island City, N. Y.
Manhattan Rubber Mfg., Div. of Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Manheim Mfg. & Belting Co., Manheim, Pa.
Manitowoc Boiler Wks., 16th & The River, Manitowoc, Wis.
Manley Products Corp., State & Hay Sts., York, Pa.
Manufacturers Fin Coil Co., 2505 S. Pulaski Rd., Chicago Ill.
Manufacturers Machine Co., Railroad Ave., North Andover, Mass.
Maple City Stamping Co., Peoria, Ill.
Maple Valley Mfg. Co., First St., Mapleton, Ia.
Maplewood Machinery Co., Inc., 2634 Fullerton Ave., Chicago, Ill.
Marathon Electric Mfg. Corp., 131 W. Washington St., P. O. 298, Wausau, Wis.
Marble-Card Electric Co., Gladstone, Mich.
Marblehead Lime Co., 160 N. LaSalle St., Chicago, Ill.
Marion Machine, Foundry & Supply Co., P. O. Box 685, 3rd and Big Four Ry., Marion, Ind.
●Marley Co., 3001 Fairfax Rd., Kansas City, Kans.
Marlin-Rockwell Corp., Jamestown, N. Y.
●Marlo Coil Co., 6135 Manchester Ave., St. Louis, Mo.
Marquette Mfg. Co., 401 Johnson St., Minneapolis, Minn.
Marsh Corp., Jas. P., 2073 Southport Ave., Chicago, Ill.
Marsh Tritrol Co., 600 S. Michigan Ave., Chicago, Ill.
Marsh Valve Co., 4th St. & Brigham Rd., Dunkirk, N. Y.
Marshalltown Mfg. Co., 901 E. Nevada, Marshalltown, Ia.
Martin, J. O. & C. U., 637 Minna St., San Francisco, Cal.
Martin Metal Mfg. Co., 900 E. Second St., Wichita, Kans.
Martin & Sons, H. P., 801 W. 12th St., Owensboro, Ky.
Martocello & Co., Jos. A., 229 N. 13th St., Philadelphia, Pa.
Mason-Neilan Regulator Co., 1190 Adams St., Boston, Mass.
Masonite Corp., 111 W. Washington St., Chicago, Ill.
Master Electric Co., 100 Davis Ave., Dayton, O.
Matthiessen & Hegeler Zinc Co., 9th & Sterling Sts., La Salle, Ill.
Mauck Seamless Copper Tank Co., Victor, 309 E. Main, Norristown, Pa.
Maurath, Inc., 7309 Union Ave., Cleveland, O.
Maxim Silencer Co., 410 Asylum St., Hartford, Conn.
Mayflower Air-Conditioners, Inc., Newcomb & E. 7th St., St. Paul, Minn.
Mayson Mfg. Co., Inc., 4332 Horatio St., Detroit, Mich.
Maysteel Products, Inc., Horicon St., Mayville, Wis.
●McAlear Mfg. Co., 1901-1909 S. Western Ave., Chicago, Ill.
McAuley Trap Co., 405 Penn Ave., Pittsburgh, Pa.
McCann Furnace Co., 5005 Euclid Ave., Cleveland, O.
●McCord Radiator & Mfg. Co., 2587 E. Grand Blvd., Detroit, Mich.
McCorkle Co., D. H., 6th & Bancroft Way, Berkeley, Cal.
●McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill.
McKay Co., York, Pa.
McLeod & Henry Co., Inc., Troy, N. Y.
McLouth Air Conditioning Corp., 2400 E. Michigan Ave., Lansing, Mich.
McPherson Furnace & Supply Co., 1805 N. E. Second Ave., Portland, Ore.
●McQuay, Inc., 1600 Broadway, N. E., Minneapolis, Minn.
McQuay-Norris Mfg. Co., Southwest Ave. at Marconi, St. Louis, Mo.
McWane Cast Iron Pipe Co., 1201 Vanderbilt Rd., Birmingham, Ala.
Mears-Kane-Ofeldt, Inc., 1903-1915 E. Hagert St., Philadelphia, Pa.
Medart Co., 3500 DeKalb, St. Louis, Mo.
Meier Electric & Machine Co., 3525 E. Washington St., Indianapolis, Ind.
Mellish & Murray Co., 1715 Carroll Ave., Chicago, Ill.
Merchant & Evans Co., 2035 Washington Ave., Philadelphia, Pa.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Merco-Nordstrom Valve Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Mercury Clutch Corp., 637 W. Third St., Massillon, O.
Meriam Co., The, 1955 W. 112th St., Cleveland, O.
Merrell Mfg. Co., 644 Curtis St., Toledo, O.
Metal & Thermit Corp., 120 Broadway, New York, N. Y.
Metalace Corp., 60 K St., South Boston, Mass.
Metallo Gasket Co., 16 Bethany St., New Brunswick, N. J.

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Metropolitan Refining Co., Inc., 23-28 50th Ave., Long Island City, N. Y.
Mettler Co., Lee B., 406 S. Main St., Los Angeles, Cal.
Meyer & Bro. Co., F., 1313 S. Adams St., Peoria, Ill.
Meyer Furnace Co., 1300 S. Washington St., Peoria, Ill.
Meyer Mfg. Co., 4823 Wabash Ave., Detroit, Mich.
Micheli Air Conditioning Co., Inc., 1725 State St., Schenectady, N. Y.
Michigan Pipe Co., 503 Phoenix Bldg., Bay City, Mich.
Micro Products Co., 20 N. Wacker Dr., Chicago, Ill.
Micro Switch Corp., 1 E. Spring St., Freeport, Ill.
Micro-Westco, Inc., Bettendorf Office Bldg., Bettendorf, Ia.
Middleton Mfg. & Sales Co., 125 N. First St., Minneapolis, Minn.
Midwest Piping & Supply Co., Inc., Second and Barry St., St. Louis, Mo.
Milburn Co., Alexander, 1426 W. Baltimore St., Baltimore, Md.
Milcor Steel Co., S. 41st & Burnham Sts., Milwaukee, Wis.
Miller & Connell Co., 3720 W. North Ave., Chicago, Ill.
Miller Electric Mfg. Co., Inc., 905 N. Meade St., Appleton, Wis.
Miller Rubber Co., Inc., 1247 S. High St., Akron, O.
Millers Falls Co., 57 Wells St., Greenfield, Mass.
Mills Novelty Co., 4110 W. Fullerton Ave., Chicago, Ill.
Milwaukee Gas Specialty Co., 2025 W. Clybourn St., Milwaukee, Wis.
Milwaukee Reliance Boiler Wks., 2784 N. 32nd St., Milwaukee, Wis.
Milwaukee Valve Co., S. Burrell St. at E. Hayes Ave., Milwaukee, Wis.
Mineral Insulation Co., 103rd & Southwest Highway, Chicago Ridge, Ill.
●Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., South, Minneapolis, Minn.
Minn-Kota Foundry & Mfg. Co., 201 Second St., N., Fargo, N. D.
Misener Mfg. Co., Inc., 326 E. Washington St., Syracuse, N. Y.
Mississippi Glass Co., 220 Fifth Ave., New York, N. Y.
Mitchell Moulding Co., 1501-15 Circle Ave., Forest Park, Ill.
Mitchell & Smith, Inc., 9469 Copeland Ave., Detroit, Mich.
Modern Engineering Co., 3411 Pine Blvd., St. Louis, Mo.
Modern Equipment Corp., Defiance, O.
Modine Mfg. Co., 1772 Racine St., Racine, Wis.
Moeller Instrument Co., 132nd St. & 89th Ave., Richmond Hill, N. Y.
Mojonnier Bros. Co., 4601 W. Ohio St., Chicago, Ill.
Molock Foundry & Machine Co., Kaukauna, Wis.
Monarch Mfg. Works, Inc., Salmon & Westmoreland Sts., Philadelphia, Pa.
Monash-Younker Co., 1315 W. Congress St., Chicago, Ill.
Moncrief Furnace Co., P. O. Box 1673, Atlanta, Ga.
Monitor Controller Co., The, 51 S. Gay St., Baltimore, Md.
Monmouth Products Co., 1929-41 E. 61st St., Cleveland, O.
Monsanto Chemical Co., Organic Chemicals Div., St. Louis, Mo.
Montag Stove & Furnace Wks., 2011 N. Columbia Blvd., Portland, Ore.
Montgomery Bros., 61 Fremont St., San Francisco, Cal.
Moore Steam Turbine Div., Worthington Pump & Machinery Corp., Wellsville, N. Y.
Moran Flexible Steam Joint Co., 217 W. Main St., Louisville, Ky.
Morehead Mfg. Co., 4895 Grand River Ave., Detroit, Mich.
Morey & Jones, Ltd., 922 S. Hemlock St., Los Angeles, Cal.
Morris Machine Wks., 50 E. Genesee St., Baldwinsville, N. Y.
Morrison Products, Inc., E. 168th St. and Waterloo Rd., Cleveland, O.
Morse Chain Co., Turner Pl., Ithaca, N. Y.
Mortell Co., J. W., 310 S. Michigan Ave., Chicago, Ill.
Motex Metal Process Corp., 4473-4475 W. Jefferson Ave., Detroit, Mich.
Mouat Vapor Heating Co., The, 1246-1254 W. 4th St., Cleveland, O.
Mountain States Equipment Co., 1238 Speer Blvd., Denver, Colo.
●Mueller Brass Co., Port Huron, Mich.
Mueller Co., Decatur, Ill.
●Mueller Furnace Co., L. J., 2005 W. Oklahoma Ave., Milwaukee, Wis.
Mueller Steam Specialty Co., Inc., 40-20 22nd St., Long Island City, N. Y.
Muncie Gear Wks., Inc., 700 N. Wysor, Muncie Ind.
●Mundet Cork Corp., 65 S. 11th St., Brooklyn, N. Y.
Mundt & Sons, Charles, Jersey City, N. J.
Munn and Steele, Inc., 130 Lister Ave., Newark, N. J.
Murray Iron Wks. Co., 1106 Washington St., Burlington, Ia.
●Murray Mfg. Co., D. J., Wausau, Wis.
Mutual Chemical Co. of America, 270 Madison Ave., New York, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
Myers Electric Co., Inc., 410 Third Ave., Pittsburgh, Pa.

N

●Nash Engineering Co., South Norwalk, Conn.
Nash Refrigeration Co., Inc., 79 Poinier St., Newark, N. J.
Nason Co., 1050 Mt. Elliott Ave., Detroit, Mich.
National Airoil Burner Co., Inc., 1284 E. Sedgley Ave., Philadelphia, Pa.
National Aluminate Corp., 6621 W. 66th Pl., Chicago, Ill.
National Brass Co., 1603 Madison Ave., Grand Rapids, Mich.
National Brass & Copper Co., Inc., Lisbon, O.
National Carbon Co., Carbon Sales Div., P. O. Box 6087, Cleveland, O.
National Cylinder Gas Co., 205 W. Wacker Dr., Chicago, Ill.
National Engineering Products, Inc., Commerce and Savings Bldg., Washington, D. C.
National Gypsum Co., Delaware Ave., Buffalo, N. Y.
National Heating Co., 411 Essex Bldg., Minneapolis, Minn.
National Lead Co., 111 Broadway, New York, N. Y.
●National Machine Wks., Peoples Gas Bldg., Chicago, Ill.
National Mfg. Corp., 151 Fillmore Ave., Tonawanda, N. Y.
National Mfg. & Engineering Co., 1441 Brooklyn Ave,. Detroit, Mich.
National Metal Products Corp., 21 N. Loomis St., Chicago, Ill.
National Meter Co., 4221 First Ave., Brooklyn, N. Y.
National Pipe Bending Co., 122 River St., New Haven, Conn.
National Radiator Co., The, 221 Central Ave., Johnstown, Pa.
National Safety Device Co., 836 W. Hubbard, Chicago, Ill.
National Steam Pump Co., 701 W. Johnson St., Upper Sandusky, O.
National Time & Signal Corp., 600 E. Milwaukee Ave., Detroit, Mich.
National Tube Co., United States Steel Corp. Subsidiary, Frick Bldg., Pittsburgh, Pa.
National Valve & Mfg. Co., 3101 Liberty Ave., Pittsburgh, Pa.
Naugatuck Mfg. Co., Union City, Conn.
Naylor Pipe Co., 1251 E. 92nd St., Chicago, Ill.
Nebel Mfg. Co., P. O. Box 3942, Shaker Sta., Cleveland, O.
Neemes Foundry, Inc., 216 First St., Troy, N. Y.
Nelson Chemical Pumps, Box 2235, Casper, Wyo.
Nelson Co., 2604 Fourth Ave., Detroit, Mich.
Nelson Corp., Herman, 2nd St., Moline, Ill.
Nelson Mfg. Co., B. F., Corner Main & Marshall Sts., N. E., Minneapolis, Minn.
Neptune Meter Co., 50 W. 50th St., New York, N. Y.
●Nesbitt, Inc., John J., State Rd. & Rhawn St., Philadelphia, Pa.
Nevinger Mfg. Co., Greenville, Ill.
New Albany Machine Mfg. Co., E. 10th & Water Sts., New Albany, Ind.
New Departure Div., General Motors Sales Corp., Bristol, Conn.
●New England Cooling Tower Co., 32 Cambridge St., Chas. Sta., Boston, Mass.
New Haven Copper Co., Seymour, Conn.
New Jersey Zinc Sales Co., Front & Fletcher Sts., New York, N. Y.
New York Air Valve Corp., 611-621 Broadway, New York, N. Y.
New York Blower Co., 3155 Shields Ave., Chicago, Ill.
New York Brass Foundry, 405 Broome St., New York, N. Y.
Newark Wire Cloth Co., 351 Verona Ave., Newark, N. J.
Newman Brothers, Inc., 666 W. Fourth St., Cincinnati, O.
Newman Co., Inc., 6 E. 45th St., New York, N. Y.
Newport Rolling Mill Co., Div. of The Andrews Steel Co., Ninth & Lowell Sts., Newport, Ky.
Niagara Blower Co., 6 E. 45th St., New York, N. Y.
Niagara Machine & Tool Wks., 637-697 Northland Ave., Buffalo, N. Y.
Nice Ball Bearing Co., 30th and Nicetown Lane, Philadelphia, Pa.
Nicholson & Co., W. H., 12 Oregon St., Wilkes-Barre, Pa.
Niles Rolling Mill Co., Niles, O.
Norgren Co., Inc., C. A., 222 Santa Fe Dr., Denver, Colo.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Norman Sheet Metal Mfg. Co., W. F., 212-236 N. Cedar St., Nevada, Mo.
Norristown Magnesia & Asbestos Co., Washington St., Norristown, Pa.
North American Fibre Products Co., The, Keith Bldg., Cleveland, O.
North American Mfg. Co., 2910 E. 75th, Cleveland, O.
Northern Blower Co., 6409 Barberton Ave., Cleveland, O.
Northern Equipment Co., 1945 Grove Drive, Erie, Pa.
Northern Indiana Brass Co., 935 Plum St., Elkhart, Ind.
Northern Steel and Stoker Co., 3100 Prospect Rd., Peoria, Ill.
Northern Weatherstrip Co., 367 S. First Ave., E. Duluth, Minn.
Northwest Stove Works, 2345 S. E. Gladstone St., Portland, Ore.
Norwin Co., E. Album St., Freeport, Ill.
Norwood Filtration Co., The, N. Maple St., Florence, Mass.
Nu-Way Corp., 2416-4th Ave., Rock Island, Ill.
Nye Tool & Machine Wks., The, 4120-30 Fullerton Ave., Chicago, Ill.

O

Oakite Products, Inc., 22 Thames St., New York, N. Y.
Oberdorfer Brass Co., M. L., 2307 Thompson Rd., Syracuse, N. Y.
O'Brien Varnish Co., South Bend, Ind.
Ohio Brass Co., N. Main St., Mansfield, O.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Works & Foundry Co., Eureka Valve Div., 2735 Colerain Ave., Cincinnati, O.
Ohio Pipe Bending & Machine Co., 3900-3910 Trent Ave., Cleveland, O.

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Ohio Products Co., 16507 Lucille Ave., Cleveland, O.
Ohl & Son, George A., 159 Oraton St., Newark, N. J.
Ohmlac Paint & Refining Co., 6540 S. Central Ave., Chicago, Ill.
Oil City Tank & Boiler Co., Oil City, Pa.
Oil Well Supply Co., Oil City, Pa.
●O'Neil-Irwin, Inc., 316 Eighth Ave., S., Minneapolis, Minn.
Ormsby-Osterman Co., 3631 Cass Ave., St. Louis, Mo.
Orr & Sembower, Inc., Box 817, Reading, Pa.
Osborn Co., The J. M. & L. A., 1541 E. 38th St., Cleveland, O.
Oster Mfg. Co., 2057 E. 61st Pl., Cleveland, O.
Ostlind Valve, Inc., Portland, Ore.
Owen Dyneto Div., U. S. L. Battery Corp., Syracuse, N. Y.
●Owens-Corning Fiberglas Corp., Nicholas Bldg., Toledo, O.
Ozalid Products Div., General Aniline & Film Corp., Ansco Rd., Johnson City, N. Y.
Ozone Air Co., 928 Cherry St., S. E., Grand Rapids, Mich.
Ozo-Ray Process Corp., 400 N. Sangamon St., Chicago, Ill.

P

PS Inc., 1227-35 Wall St., Los Angeles, Cal.
Pacific Gas Radiator Co., Huntington Park, Cal.
Pacific Lumber Co., The, 100 Bush St., San Francisco, Cal.
Pacific Pump Works, 5716 Bickett St., Huntington Park, Cal.
Pacific States Felt & Mfg. Co., Inc., 845 Howard St., San Francisco, Cal.
Pacific Steel Boiler Div., United States Radiator Corp., 1056 First National Bank Bldg., Detroit, Mich.
Packless Metal Products Corp., 31 Winthrop Ave., New Rochelle, N. Y.
Page Steel & Wire, Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Paine Co., 2951 W. Carroll Ave., Chicago, Ill.
Pains Fireworks Display Co., 22 Park Pl., New York, N. Y.
Palmer Co., 2501 Norwood Ave., Cincinnati (Norwood), O.
Palmer Electric Co., 20 Sproat St., Detroit, Mich.
Palmer Mfg. Corp., Phoenix, Ariz.
Palnut Co., 57 Cordier St., Irvington, N. J.
Pan-American Engineering Co., 820 Parker St., Berkeley, Cal.
Pangborn Corp., Pangborn Blvd., Hagerstown, Md.
Paragon Electric Co., 37 W. Van Buren St., Chicago, Ill.
Paragon-Revolute Corp., 65 South Ave., Rochester, N. Y.
Paramount Products Co., 545 Fifth Ave., New York, N. Y.
Parker Appliance Co., The, 17325 Euclid Ave., Cleveland, O.
Parker-Kalon Corp., 200 Varick St., New York, N. Y.
Parkersburg Iron & Steel Co., Parkersburg, W. Va.
Parks-Cramer Co., 970 Main St., Fitchburg, Mass.
Parmelee Mfg. Corp., 1925 Dwyer Ave., Utica, N. Y.
Patten Co., J. V., 500 De Kalb Ave., Sycamore, Ill.
Patterson-Ballagh Corp., 1900 E. 65th St., Los Angeles, Cal.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Patterson Shade Co., 1142 N. Meridian St., Indianapolis, Ind.
Paxtix, Inc., 308 W. Washington St., Chicago, Ill.
Payne Furnace & Supply Co., Inc., 336-338 N. Foothill Rd., Beverly Hills, Cal.
Peabody Engineering Corp., 580 Fifth Ave., New York, N. Y.
Pease Co., C. F., The, 2601 W. Irving Park Rd., Chicago, Ill.
Peck & Harvey, 4327 W. Addison St., Chicago, Ill.
Peck, Stow & Wilcox Co., Center St., Southington, Conn.
●Pecora Paint Co., 4th & Penna. R. R., Philadelphia, Pa.
Pedrick Tool & Machine Co., 3640 N. Lawrence St., Philadelphia, Pa.
Peerless of America, Inc., 515 W. 35th St., Chicago, Ill.
Peerless Electric Co., 3021 W. Market St., Warren, O.
Peerless Machine Co., 1600 Junction Ave., Racine, Wis.
Peerless Pump Div., Food Machinery Corp., 1250 Camden Ave., S. W., Canton, O.
Peerless Unit Ventilation Co., Inc., 810 Union Ave., Bridgeport, Conn.
Pels & Co., Inc., Henry, 90 West St., New York, N. Y.
Penberthy Injector Co., 1242 Holden Ave., Detroit, Mich.
Penn Electric Switch Co., Box 556, Goshen, Ind.
Penn Mfg. Corp. of Washington, Pa., 380 W. Chestnut St., P. O. Box 484, Washington, Pa.
Penn Ventilating Co., 3252 Goodman St., Philadelphia, Pa.
Pennsylvania Engineering Wks., 526 S. Jefferson St., New Castle, Pa.
Pennsylvania Flexible Metallic Tubing Co., 72nd St. and Powers Lane, Philadelphia, Pa.
Pennsylvania Forge Co., Milnor & Bleigh Sts., Philadelphia, Pa.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.
% Proportioneers, Inc. %, 9 Codding St., Providence, R. I.
Perfect Circle Co., The, Hagerstown, Ind.
Perfection Grate & Stoker Co., 4 Fiske Ave., Springfield, Mass.
Perfection Refrigeration Parts Co., Harvey, Ill.
Perfex Corp. (Controls Div.), 500 W. Oklahoma Ave., Milwaukee, Wis.
Perham Products, Inc., 133 N. Wacker Dr., Chicago, Ill.
Perkins Machine Co., 4 Perkins Ave., Warren, Mass.
Perkins & Son, Inc., B. F., Chicopee St., Holyoke, Mass.
Permatex Co., Inc., Sheepshead Bay, N. Y.
Permutit Co., 330 W. 42nd St., New York, N. Y.
Pernot & Rich, Inc., 2546 San Fernando Rd., Los Angeles, Cal.
Peterson Freezem Mfg. & Sales Co., 322 Southwest Blvd., Kansas City, Mo.
●Petroleum Heat & Power Co., Stamford, Conn.
Petrometer Corp., 1 Star Sq., Long Island City, N. Y.
Pfening Co., Fred D., 1075 W. 5th Ave., Columbus, O.
Phelps Dodge Copper Products Corp., British American Tube Div., 40 Wall St., New York, N. Y.
Phelps Mfg. Co., 801 Thomas St., Little Rock, Ark.
Philadelphia Gear Works, Inc., Erie Ave. & G St., Philadelphia, Pa.
Philadelphia Pipe Bending Co., 4135-65 N. Fifth St., Philadelphia, Pa.
Philadelphia Thermometer Co., 915 Filbert St., Philadelphia, Pa.
Philco Corp., Tioga and C Sts., Philadelphia, Pa.
Phillips & Co., H. A., 3255 W. Carroll Ave., Chicago, Ill.
Phillips Cooling Tower Co., Inc., 114 Liberty St., New York, N. Y.
Phoenix Brass Fittings Corp., Colt St. & Chancellor Ave., Irvington, N. J.
Phoenix Ice Machine Co., 2711 Church St., Cleveland, O.
Phoenix Ventilator Co., Inc., 1665 63rd St., Brooklyn, N. Y.
Pier Equipment Mfg. Co., 1440 Milton St., Benton Harbor, Mich.
Pierce Butler Radiator Corp., 701 Nichols Ave., Syracuse, N. Y.
Pierce Co., Wm. B., The, 41 N. Division St., Buffalo, N. Y.
Pilley Brush Co., Fort Madison, Ia.
Pioneer Heat Regulator Div., Master Electric Co., The, 100 Davis Ave., Dayton, O.
Pioneer Roofing & Sheet Metal Co., 226 N. Main St., Muskogee, Okla.
Pipe Fabrication Institute, 1108 Clark Bldg., Pittsburgh, Pa.
Pittsburgh Brass Mfg. Co., 3155 Penn Ave., Pittsburgh, Pa.
Pittsburgh Equitable Meter Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Pittsburgh Lectrodryer Corp., P. O. Box 1766, Pittsburgh, Pa.
Pittsburgh Pipe Coil & Bending Co., 61 Bridge St., Etna, Pa.
Pittsburgh Piping & Equipment Co., 43rd St. & A. V. R. R., Pittsburgh, Pa.
Pittsburgh Plate Glass Co., 2000 Grant Bldg., Pittsburgh, Pa.
Pittsburgh Steel Co., Grant Bldg., Pittsburgh, Pa.
Pittsburgh Tube Co., Vandergrift Bldg., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Pittsburgh Water Heater Co., Box 1109, Pittsburgh, Pa.
Plant Rubber & Asbestos Works, 537 Brannan St., San Francisco, Cal.
Plastergon Wall Board Co., Philadelphia Ave., Buffalo, N. Y.
Plastic Products Co., 6475 Georgia Ave., Detroit, Mich.
Pleasantaire Corp., Tower Bldg., Washington, D. C.
Plummer Spray Equipment Co., 700 Filmore St., Napoleon, O.
Plymouth Cordage Co., Court St., N. Plymouth, Mass.; Anderson Products, Inc., Cambridge, Mass., National Sales Agents.
Poe Co., C. W., 2795 E. 83rd St., Cleveland, O.
Pomona Pump Co., 206 E. Commercial St., Pomona, Cal.
Poole Foundry & Machine Co., 1700 Union Ave., Woodberry, Baltimore, Md.
●Porter & Co., Inc., H. W., 825 Frelinghuysen Ave., Newark, N. J.
Powell Co., Wm., 2525 Spring Grove Ave., Cincinnati, O.
Power King Tool Corp., P. O. Box 150, Warsaw, Ind.
Power Piping Div., Blaw Knox Co., 829 Beaver Ave., Pittsburgh, Pa.
●Powers Regulator Co., 2720 Greenview Ave., Chicago, Ill.
Practical Instrument Co., 2717 N. Ashland Ave., Chicago, Ill.
Prat-Daniel Corp., Port Chester, N. Y.
Precision Control Co., 899 Bryant St., San Francisco, Cal.
Precision Thermometer & Instrument Co., 1434 Brandywine St., Philadelphia, Pa.
Preferred Utilities Mfg. Corp., 33 W. 60th St., New York, N. Y.
Premier Furnace Co., Box 150, Dowagiac, Mich.
Presstite Engineering Co., 3900 Chouteau St., St. Louis, Mo.
Pritchard & Co., J. F., 518 Dwight Bldg., Kansas City, Mo.
Propellair, Inc., 1345 Lagonda Ave., Springfield, O.
Prox Co., Inc., Frank, 1201 S. First St., Terre Haute, Ind.
Public Works Supply Co., 93 Brookline St., Lynn, Mass.
Puhl & Hepper Mfg. Co., 6400 W. Florissant Ave., St. Louis, Mo.
Purdue Associates, Inc., Albert G., 303 Wooster St., New Haven, Conn.
Pure Carbonic, Inc., 60 E. 42nd St., New York, N. Y.
Pyott Foundry & Machine Co., 328 N. Sangamon St., Chicago, Ill.
Pyrolite Products Co., Cleveland, O.
Pyrometer Instrument Co., 103 Lafayette St., New York, N. Y.

Q

Quaker City Iron Wks., Allegheny & Tulip Sts., Philadelphia, Pa.
Quaker Rubber Corp., Comly & Milnor, Philadelphia, Pa.
Quickwork-Whiting, Div. of Whiting Corp., Harvey, Ill.
Quiet Heet Mfg. Co., 135 New Jersey R. R. Ave., Newark, N. J.
Quigley Co., Inc., 56 W. 45th St., New York, N. Y.
Quimby Pump Co., Inc., 340 Thomas St., Newark, N. J.

R

R-S Products Corp., Germantown Ave., at Wayne Junction, Philadelphia, Pa.
R. U. V. Engineering Corp., 110 E. 42nd St., New York, N. Y.
Radiator Specialty Co., Charlotte, N. C.
Rafter Machine Co., 259 Stephens St., Belleville, N. J.
Raisler Corp., Grimes Sprinkler Div., 129 Amsterdam Ave., New York, N. Y.
Ramsay Chain Co., Inc., 1029 Broadway, Albany, N. Y.

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Ramtite Co., The, 2563 W. 18th St., Chicago, Ill.
Ranco, Inc., 601 W. 5th Ave., Columbus, O.
●**Randall Graphite Products Corp., 609 W. Lake St., Chicago, Ill.**
Ransome Concrete Machinery Co., Dunellen, N. J.
Ravena Iron Co., Ravena, N. Y.
Rawlplug Co., Inc., The, 98 Lafayette St., New York, N. Y.
Ray Oil Burner Co., 401-499 Bernal Ave., San Francisco, Cal.
●**Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.**
Red Jacket Mfg. Co., Davenport, Ia.
Red Spot Electric Co., 4302 S. Tacoma Way, Tacoma, Wash.
Reed Unit-Fans, Inc., 811 St. Charles St., New Orleans, La.
Reeves Pulley Co., 1000 N. Wilson St., Columbus, Ind.
Reeves Steel & Mfg. Co., Dover, O.
Refinite Corp., Refinite Bldg., Omaha, Neb.
Refractory & Insulation Corp., 381 Fourth Ave., New York, N. Y.
Refrigeration Appliances, Inc., 917-923 W. Lake St., Chicago, Ill.
Refrigeration Economics Co., Inc., 1232 Second St., N. E., Canton, O.
Rega Mfg. Co., 79 Mt. Hope Ave., Rochester, N. Y.
●Register & Grille Mfg. Co., Inc., 70 Berry St., Brooklyn, N. Y.
Reichert Float & Mfg. Co., 2238 Smead Ave., Toledo, O.
Reif-Rexoil, Inc., 37-43 Carroll St., Buffalo, N. Y.
Reilly Tar & Chemical Corp., 1615 Merchants Bank Bldg., Indianapolis, Ind.
Reiner & Campbell, Inc., 667 Norwood Terrace, Elizabeth, N. J.
Reliable Perforating Co., 2047 N. Wood St., Chicago, Ill.
Reliance Automatic Lighting Co., 1929 Mead St., Racine, Wis.
Reliance Electric & Engineering Co., Ivanhoe Rd., Cleveland, O.
Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland, O.
Reliance Refrigerating Machine Co., 3401 N. Kedzie Ave., Chicago, Ill.
Rempe Co., 340 N. Sacramento Blvd., Chicago, Ill.
Rensselaer Valve Co., Ontario St., Cohoes, N. Y.
Reps Tool, Inc., 220 Delaware Ave., Buffalo, N. Y.
Republic Flow Meters Co., 2240 Diversey Pkwy., Chicago, Ill.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
Republic Steel Corp., Republic Bldg., Cleveland, O.
Republic Steel Corp., Bolt & Nut Div., 1500 Scranton Rd., Cleveland, O.
Research Corp., Chrysler Bldg., New York, N. Y.
●**Research Products Corp., 1011-1015 E. Washington Ave., Madison, Wis.**
Resisto Pipe & Valve Co., 262 Bridge St., East Cambridge, Mass.
Resistoflex Corp., Belleville, N. J.
Revere Copper and Brass, Incorporated, 230 Park Ave., New York, N. Y.
Rex Clay Products Co., 14414 Dexter Blvd., Detroit, Mich.
Reynolds Electric Co., 2603 W. Congress, Chicago, Ill.
Reynolds Mfg. Co., The, 412 Prospect St., N. E., Grand Rapids, Mich.
Reynolds Mfg. Co., Inc., Springfield, Mo.
Reynolds Metals Co., Federal Reserve Bank Bldg., Richmond, Va.
●Reznor Mfg. Co., Mercer, Pa.
●**Rhoads & Sons, J. H., 35 N. Sixth St., Philadelphia, Pa.**
Rhode Island Fittings Co., Hillsgrove, R. I.
Rhode Island Humidifier & Ventilating Co., 99 Chauncey St., Boston, Mass.
Rhodes, Inc., M. H., 30 Bartholomew Ave., Hartford, Conn.
Richmond Engineering Co., Inc., 7th and Hospital Sts., Richmond, Va.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
●**Ric-wiL Co., 1563 Union Trust Bldg., Cleveland, O.**
Ridge Tool Co., Box 670, Elyria, O.
Riley Stoker Corp., 9 Neponset St., Worcester, Mass.
Robbins & Myers, Inc., Lagonda Ave., Springfield, O.
Roberts-Gordon Appliance Corp., 137 Arthur St., Buffalo, N. Y.
Roberts-Hamilton Co., 707-715 S. Third St., Minneapolis, Minn.
Roberts Tube Works, 2500 Military Ave., Detroit, Mich.
Robertson Co., H. H., 2000 Grant Bldg., Pittsburgh, Pa.
Robinson Insulation Co., Great Falls, Mont.
Rochester Lead Works, Inc., 380 Exchange St., Rochester, N. Y.
Rochester Mfg. Co., Inc., 100 Rockwood St., Rochester N. Y.
Rock Island Register Co., 2435 Fifth Ave., Rock Island, Ill.
Rock River Machine Co., Inc., N. Main St., Janesville, Wis.
Rock Wool Products Co., P. O. Box 276, Wabash, Ind.
Rockford Brass Works, Rockford, Ill.
Rockwood Mfg. Co., 1801-2001 English Ave., Indianapolis, Ind.
Rockwood Sprinkler Co., 38 Harlow St., Worcester, Mass.
Roebling's Sons, John A., 640 S. Broad St., Trenton, N. J.
Roessing Mfg. Co., 1616 Noble St., Sharpsburg Sta., Pittsburgh, Pa.
Roller Bearing Co. of America, Whitehead Rd., Trenton, N. J.
Rolyan Corp., 2241 Indiana Ave., Chicago, Ill.
Rome-Turney Radiator Co., Canal St., Rome, N. Y.
Roots-Connersville Blower Corp., 16th St. & Columbia Ave., Connersville, Ind.
Roper Corp., Geo. D., Blackhawk Ave., Rockford, Ill.
Rosebraugh Co., W. W., 680 S. 17th St., Salem, Ore.
Rosedale Foundry & Machine Co., Columbus & Preble Aves., N. S., Pittsburgh, Pa.
Ross Engineering Corp., J. O., 350 Madison Ave., New York, N. Y.
Ross Heater & Mfg. Co., Inc., 1407 West Ave., Buffalo, N. Y.
Ross Sprinkler Co., 34 Roberts St., Pasadena, Cal.
Ross Valve Mfg. Co., Inc., 6 Oakwood Ave., Troy, N. Y.
Rotary Mfg. Co., 5718 Long Beach Ave., Los Angeles, Cal.
Rotary Seal Co., 2020 N. Larrabee St., Chicago, Ill.
Roxalin Flexible Lacquer Co., Inc., 800 Magnolia Ave., Elizabeth, N. J.
Royal Air Conditioning Equipment Co., 1024 Westminster Ave., Alhambra, Cal.
Royal Ventilator Co., 415 Locust St., Philadelphia, Pa.
Royersford Foundry & Machine Co., Inc., Royersford, Pa.
Ruberoid Co., 500 Fifth Ave., New York, N. Y.
Ruby Chemical Co., 74 McDowell St., Columbus, O.
Ruemelin Mfg. Co., 3860 N. Palmer St., Milwaukee, Wis.
Ruggles-Klingemann Mfg. Co., 4 Foster Ct., Salem, Mass.
Rupprig̈ht, Siegfried, 28 E. 31st St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Russell Co., F. C., 1836 Euclid Ave., Cleveland, O.
Russell & Co., W. A., Bridgeport, Conn.
Russell Electric Co., 348 W. Huron St., Chicago, Ill.
Russell Mfg. Co., John M., Naugatuck, Conn.
●Rutland Fire Clay Co., Curtis Ave., Rutland, Vt.
Ruud Mfg. Co., 2934 Smallman St., Pittsburgh, Pa.
Ryerson & Son, Inc., Jos. T., 2558 W. 16th St., Chicago, Ill.
Ryniker Sheet Metal Works, Inc., 122-124 N. 25th St., Billings, Mont.

S

●**SKF Industries, Inc., Front St. & Erie Ave., Philadelphia, Pa.**
St. Paul Corrugating Co., Wabash and Water Sts., St. Paul, Minn.
Sac Tool Mfg., 1907 Washington Ave., St. Louis, Mo.
Sales & Co., Murray W., 801 W. Baltimore Ave., Detroit, Mich.
Salina Metal Products Co., 9th and Bishop, Salina, Kans.
Sall Mountain Co., 176 W. Adams St., Chicago, Ill.
Sampsel Time Control, Inc., Spring Valley, Ill.
Samson-United Corp., 1700 University Ave., Rochester, N. Y.
Sandberg Sheet Metal Works, 500 N. E. Union Ave., Portland, Ore.
Sangamo Electric Co., 1301 N. 11th St., Springfield, Ill.
●Sarco Co., Inc., 475 Fifth Ave., New York, N. Y.
Sauereisen Cements Co., 2308 Main St., Sharpsburg, Pa.
Saunders Sons, Inc., D., 25 Atherton St., Yonkers, N. Y.
Scaife Co., 26 Ann St., Oakmont, Pa.
Scanlan-Morris Co., Madison, Wis.
Schade Valve Mfg. Co., 2527 N. Bodine St., Philadelphia, Pa.
Schatz Mfg. Co., Fairview, Poughkeepsie, N. Y.
Schatz Venetian Blinds, Los Angeles, Cal.
Schaub Engineering Co., Fred H., 325 W. Huron St., Chicago, Ill.
Schieren Co., Chas. A., 30-38 Ferry St., New York, N. Y.
Schmieg Sheet Metal Works, 312-320 Piquette Ave., Detroit, Mich.
Schneible Co., Claude B., 3951 Lawrence Ave., Chicago, Ill.
Schoedinger, F. O., 322-358 Mt. Vernon Ave., Columbus, O.
Schramm, Inc., West Chester, Pa.
Schubert-Christy Corp., Box 166, Affton Station, St. Louis, Mo.
Schundler & Co., Inc., F. E., 45-15 Vernon Blvd., Long Island City, N. Y.
Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia, Pa.
Schwitzer-Cummins Co., Massachusetts Ave. at Fan St., Indianapolis, Ind.
Scientific Instrument Co., 531-35 W. Larned, Detroit, Mich.
Scott-Newcomb, Inc., 1922 Pine St., St. Louis, Mo.
Scott Valve Mfg. Co., 3963 McKinley Ave., Detroit, Mich.
Scovill Mfg. Co., Waterville Div., Waterville, Conn.
Sealed Power Corp., Muskegon, Mich.
Sealkote Corp., 40 S. Clinton St., Chicago, Ill.
Seamlex Co., Inc., 5-18 48th Ave., Long Island City, N. Y.
Season-Aire Corp. of America, 20 Bartlett St., Detroit, Mich.
Selas Co., The, Erie Ave. and D St., Philadelphia, Pa.
Semco Mfg. Co. 118 Third Ave., N., Nashville, Tenn.
Semet-Solvay Engineering Corp., 40 Rector St., New York, N. Y.
Semler Co., Jannette, Pa.
Seneca Rock Wool Co., 501 E. Market St., Tiffin, O.
Seneca Wire & Mfg. Co., Fostoria, O.
Servel, Inc., Electric Refrigeration & Air Conditioning Div., 119 Morton Ave., Evansville, Ind.
Service To Industry, Box 133, West Hartford, Conn.
Service Machine Co., 750-760 Broadway, Elizabeth, N. J.
Shafer Bearing Corp., 35 E. Wacker Dr., Chicago, Ill.
Shallcross Co., 48th and Grays Ferry Rd., Philadelphia, Pa.
Shallcross Controls, Inc., 121 N. Broadway, Milwaukee, Wis.
Shank Co., Cyrus, 625 W. Jackson Blvd., Chicago, Ill.
Sharon Steel Co., Sharon, Pa.
Shaw Co., Benjamin F., Second & Lombard Sts., Wilmington, Del.
Shaw-Kendall Engineering Co., 120-130 S. Superior St., Toledo, O.
●**Shaw-Perkins Mfg. Co., Oliver Bldg., Pittsburgh, Pa.**
Sheet Metal Mfg. Co., Inc., 953 Myrtle Ave., Brooklyn, N. Y.
Sheffler-Gross Co., Drexel Bldg., Philadelphia, Pa.
Shreveport Engineering Co., Inc., 1241 Dalzell St., Shreveport, La.
Sight Feed Generator Co., 14-18 N. 10th St., Richmond, Ind.
Signal Electric Mfg. Co., Menominee, Mich.
Signal Indicator Co., 140 Cedar St., New York, N. Y.

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Silvercote Products, Inc., 161 E. Erie St., Chicago, Ill.
Simmons Co., Gordon H., 926 N. Cass St., Milwaukee, Wis.
Simplex Heating Specialty Co., Inc., 1105 Church St., Lynchburg, Va.
●Simplex Mfg. Co., 198 N. Main St., Fond du Lac, Wis.
Simplex Oil Heating Corp., 21 West St., New York, N. Y.
Sims Co., 18th & Whitley Sts., Erie, Pa.
Sinker-Davis Co., 230 S. Missouri St., Indianapolis, Ind.
Sipe & Co., James B., Box 8010 S. Hills Branch, Pittsburgh, Pa.
Skidmore Corp., St. Joseph, Mich.
Skilbeck Mfg. Co., 7432-27th Ave., Kenosha, Wis.
Skilsaw, Inc., 5033 Elston Ave., Chicago, Ill.
Skinner Co., M. B., South Bend, Ind.
Skinner Engine Co., 337 W. 12th St., Erie, Pa.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., 1954 N. 9th St., St. Louis, Mo.
Skinner Irrigation Co., 1212 E. Canal St., Troy, O.
Slater Mfg. Co., 24 Water St., Wakefield, Mass.
Sly Mfg. Co., W. W., 4700 Train Ave., Cleveland, O.
Small Motors, Inc., 1322 Elston Ave., Chicago, Ill.
Smith Co., Inc., H. B., The, 57 Main, Westfield, Mass.
Smith Heater Co., Peter, 6209 Hamilton St., Detroit, Mich.
Smith, Inc., James Campbell, 1679 Collamer Rd., Cleveland, O.
Smith, Inc., Winfield H., 144 Eaton St., Springville, Erie County, N. Y.
Smith & Kanzler Corp., 516-534 Lidgerwood Ave., Elizabeth, N. J.
Smith Meter Co., 5743 E. Leneve St., Los Angeles, Cal.
Smith-Raymond Co., 1008 13th St., Columbus, Ga.
Smith Twin Tubular Boiler Co., Inc., Cottman St., at State Rd., Philadelphia, Pa.
Smith Welding Equipment Corp., 2633 S. E. Fourth St., Minneapolis, Minn.
Smolensky Valve Co., Inc., 1931 W. 47th St., Cleveland, O.
Smooth-On Mfg. Co., 568-574 Communipaw Ave., Jersey City, N. J.
Snap-On Tools Corp., Kenosha, Wis.
Snead, Herbert S., 205 E. 42nd St., New York, N. Y.
Solvay Sales Corp., 42 Rector St., New York, N. Y.
●Somers, Inc., H. J., 6063 Wabash Ave., Detroit, Mich.
Somerville Iron Wks., Somerville, N. J.
Sonneborn Sons, Inc., L., 88 Lexington Ave., New York, N. Y.
Sonner Burner Co., Winfield, Kans.
South Bend Air Products Corp., 304 E. Colfax Ave., South Bend, Ind.
South Chester Tube Co., Front & Thurlow Sts., Chester, Pa.
Southbridge Roofing Co., Inc., Hartwell and Chapin Sts., Southbridge, Mass.
Southern States Iron Roofing Co., Stiles Ave., Savannah, Ga.
Southworth Machine Co., 30 Warren Ave., Portland, Me.
●Spang Chalfant, Inc., Div. of National Supply Co., Grant Bldg., Pittsburgh, Pa.
Specialty Converters, Inc., East Braintree, Mass.
Speedmaster Co., The, 1203 Thacker St., Des Plaines, Ill.
Speedway Mfg. Co., 1834 S. 52nd Ave., Chicago (Cicero), Ill.
Spence Engineering Co., Inc., 75 West St., New York, N. Y.
Spencer Heater Div., Aviation Mfg. Corp., 164 Park St., Williamsport, Pa.
Spencer Thermostat Co., 34 Forest St., Attleboro, Mass.
Spencer Turbine Co., 486 New Park Ave., Hartford, Conn.
Spoehrer-Lange Co., 3723 Commonwealth St., St. Louis, Mo.
Spray Engineering Co., 112 Central St., Somerville, Mass.
●Spraying Systems Co., 4031 W. Lake St., Chicago, Ill.
Sprayo-Flake Co., 2715 Irving Park Blvd., Chicago, Ill.
Spray-Wheel Air Conditioners, Inc., 1320 Nineteenth St., Denver, Colo.
Sprout-Waldron & Co., Muncy, Pa.
Square D Co., 6060 Rivard St., Detroit, Mich.
Square D Co., 4041 N. Richards St., Milwaukee, Wis.
Squires Co., C. E., E. 40th St. & Kelley Ave., Cleveland, O.
Standard Asbestos Mfg. Co., 820-822 W. Lake St., Chicago, Ill.
Standard Computing Scale Co,. The, Air Conditioning and Refrigeration Div., 2461 E. Grand Blvd., Detroit, Mich.
Standard Engineering Wks., 289 Roosevelt Ave., Pawtucket, R. I.
Standard Fuel Engineering Co., 667 Post Ave., S., Detroit, Mich.
Standard Galvanizing Co., 2619 W. Van Buren St., Chicago, Ill.
Standard Heater & Oil Equipment Co., 245 Cornelison Ave., Jersey City, N. J.
Standard Lime & Stone Co., 2004 First National Bank Bldg., Baltimore, Md.
Standard Pressed Steel Co., Jenkintown, Pa.
Standard Products Co., Fisher Bldg., Detroit, Mich.
Standard Reseater Corp., 423 W. 126th St., Orange, Mass.
Standard Rolling Mills, Inc., 143 Jewel St., Brooklyn, N. Y.
Standard Stamping & Perforating Co., 3131 W. 49th Pl., Chicago, Ill.
Standard Stoker Corp., The, New Albany, Ind.
Standard Thermometer, Inc., 65 Shirley St., Boston, Mass.
Standard Transmission Equipment Co., Suite 330, 416 W. 8th St., Los Angeles, Cal.
Standard Tube Co., 14600 Woodward Ave., Highland Park, Mich.
Standard Union Co., 71 Gooding St., Lockport, N. Y.
Stanley Electric Tool Div., The Stanley Works, Elm St., New Britain, Conn.
Staples & Pfeiffer, Ltd., 528 Bryant St., San Francisco, Cal.
Star Electric Motor Co., 197 Grove St., Bloomfield, N. J.
Star Expansion Bolt Co., 147 Cedar St., New York, N. Y.
Star Mfg. Co., Inc., 530 Kinsley Ave., Providence, R. I.
Star Products Co., 130 Walnut Ave., New York, N. Y.
Starr Piano Co., Richmond, Ind.
●Staynew Filter Corp., 25 Leighton Ave., Rochester, N. Y.
Steamaire Co., Cincinnati, O.
Steel Improvement & Forge Co., 960 Addison Rd., Cleveland, O.
Steel Products Engineering Co., 1205 W. Columbia St., Springfield, O.
Steel and Tubes, Div. of Republic Steel Corp., 224 E. 131st St., Cleveland, O.
Steinhorst & Sons, Inc., Emil, 612 South St., Utica, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Cal.
Sterling Engineering & Mfg. Corp., 114 Business St., Hyde Park, Mass.
Sterling, Inc., 3738 N. Holton St., Milwaukee, Wis.
Sterling Pump Corp., Hamilton, O.
Stewart Ice Machine Co., 1046 E. 22nd St., Los Angeles, Cal.
Stickle Steam Specialties Co., 2215 Valley Ave., Indianapolis, Ind.
Stockham Pipe Fittings Co., 4100 Tenth Ave., N., Birmingham, Ala.
Stok-A-Fire Co., 6504 Olive St., University City, Mo.
Stokermatic Co., 1415 S. State St., Salt Lake City, Utah.
Stokes Rubber Co., Jos., Taylor & Webster, Trenton, N. J.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, 218 S. Geddes St., Syracuse, N. Y.
Strandwitz & Co., Inc., W. J., Jefferson and Master Sts., Camden, N. J.
Strong, Carlisle & Hammond Co., The, 1392 W. Third St., Cleveland, O.
Struthers Dunn, Inc., 1332 Cherry St., Philadelphia, Pa.
Struthers-Wells-Titusville Co., Titusville, Pa.
Stuart Co., W. W., 417 Ninth St., Des Moines, Iowa.
●Sturtevant Co., B. F., Damon St., Hyde Park, Boston, Mass.
Sudbury Laboratory, South Sudbury, Mass.
Sullivan Valve & Engineering Co., 910 S. Arizona St., Butte, Mont.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Super Radiator Corp., 320 Plymouth Bldg., Minneapolis, Minn.
Superior Railway Products Corp., 7501 Thomas Blvd., Pittsburgh, Pa.
Superior Sheet Steel Co., The, Division of Continental Steel Corp., Canton-Louisville Rd., Canton, O.
Superior Steel Corp., Grant Bldg., Pittsburgh, Pa.
Superior Valve and Fittings Co., 1509 W. Liberty Ave., Pittsburgh, Pa.
Superseal Corp., 300 Fourth Ave., New York, N. Y.
Superstat Co., 38 Walter St., Springfield, Mass.
Supreme Air Filter Co., 126 W. 21st St., New York, N. Y.
Supreme Electric Products Corp., 123 Ames St., Rochester, N. Y.
Supreme Heater & Ventilating Corp., 1911 N. Market St., St. Louis, Mo.
●Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Swaby Mfg. Co., 2330 W. Cermak Rd., Chicago, Ill.
Swaine Mfg. Co., Fred J., 1300 N. Seventh St., St. Louis, Mo.
Swartwout Co., 18511 Euclid Ave., Cleveland, O.
Swedish Venetian Blind Co., 601 W. 26th St., New York, N. Y.
Swift Mfg. Co., 247 McDougall Ave., Detroit, Mich.
Swoboda, Inc., H. O., 13th St., New Brighton, Pa.
Syntron Co., Homer City, Pa.

T

Taber Pump Co., 272 Elm St., Buffalo, N. Y.
Taco Heaters, Inc., 342 Madison Ave., New York, N. Y.
Tagliabue Mfg. Co., C. J., 540 Park Ave., Brooklyn, N. Y.
Tallmadge & Co., Webster, 364 Glenwood Ave., East Orange, N. J.
●Taylor Forge & Pipe Wks., P. O. Box 485, Chicago, Ill.
Taylor-Hall Welding Corp., 99 Hope Ave., Worcester, Mass.
●Taylor Instrument Companies, 95 Ames St., Rochester, N. Y.
Taylor-Winfield Corp., 1052 Mahoning Ave., Warren, O.
Technical Ply-Woods, 228 N. LaSalle St., Chicago, Ill.
Tecumseh Products Co., Tecumseh, Mich.
Telsit Insulation Co., 1933 West Farms Rd., Bronx, N. Y.
Tempil Corp., 132 W. 22nd St., New York, N. Y.
Templeton Bros., 189 Belgrade Ave., Roslindale Station, Boston, Mass.
Templeton Mfg. Co., 114 Business St., Hyde Park, Mass.
Temprite Products Corp., 47 Piquette Ave., Detroit, Mich.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Tennessee Products Corp., American National Bank Bldg., Nashville, Tenn.
Tenney Engineering, Inc., 46 Farrand St., Bloomfield, N. J.
Terry Steam Turbine Co., The, P. O. Box 1200, Hartford, Conn.
Textite Corp., 2110 Roscoe St., Chicago, Ill.
Thatcher Furnace Co., 39 St. Francis St., Newark, N. J.
Thermal Co., Inc., 1434 N. Fourth St., Milwaukee, Wis.
Thermal Engineering Associates, 1618 North Shore Ave., Chicago, Ill.
Therminsul Corp., 1603 Fulford St., Kalamazoo, Mich.
Thermoid Rubber, Div. of Thermoid Co., Whitehead Rd., Trenton, N. J.
Thermo-Mix, Inc., 4009 21st St., Long Island City, N. Y.
Thompson & Co., Box 6757, Pittsburgh, Pa.
Thomson-Gibb Electric Welding Co., 161 Pleasant St., Lynn, Mass.

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Thrush & Co., H. A., Peru, Ind.
Thwing-Albert Instrument Co., Penn and Pulaski Sts., Philadelphia, Pa.
Tierney Rotor Ventilator Co., 239 Fourth Ave., S., Minneapolis, Minn.
Tiffin Eaves Trough Clamp Co., 25 Miami, Tiffin, O.
●Tilco-Fin, Inc., 58 Second Ave., Brooklyn, N. Y.
Timken Roller Bearing Co., 1835 Dueber Ave., S. W., Canton, Ohio.
Timken Steel & Tube Co., Canton, O.
Tippett & Wood, Morris and Warren Sts., Phillipsburg, N. J.
Titeflex Metal Hose Co., 500 Frelinghuysen Ave., Newark, N. J.
Titusville Iron Wks. Co., S. Franklin St., Titusville, Pa.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
Todd Combustion Equipment, Inc., 601 W. 26th St., New York, N. Y.
Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo, Ohio.
Torchweld Equipment Div., National Cylinder Gas Co., 1035 W. Lake St., Chicago, Ill.
Torit Mfg. Co., 292 Walnut St., St. Paul, Minn.
Tork Clock Co., Inc., 1 Grove St., Mt. Vernon, N. Y.
Torrey Refrigeration Products, 1000 N. Orange Dr., Los Angeles, Cal.
Torrington Co., The, Torrington, Conn.
●Torrington Mfg. Co., 70 Franklin St., Torrington, Conn.
Trade-Wind Motorfans, Inc., 5725 S. Main St., Los Angeles, Cal.
Trageser Steam Copper Wks., John, 5000 Grand St., Maspeth, Long Island, N. Y.
●Trane Co., La Crosse, Wis.
Trent Co., Harold E., 55th and Wyalusing, Philadelphia, Pa.
Trerice Co., H. O., 1420 W. Lafayette Blvd., Detroit, Mich.
Triangle Mfg. Co., 396 Division St., Oshkosh, Wis.
Trimont Mfg. Co., 55-71 Amory St., Roxbury, Boston, Mass.
Trimount Rotary Power Co., 398 Whiting Ave., East Dedham, Mass.
Trindl Products, Ltd., 2227 Calumet Ave.. Chicago, Ill.
Triplex Heating Specialty Co., 252 N. Grant, Peru, Ind.
Triumph Ice Machine Co., 107-109 E. Front St.. Cincinnati, O.
Tropical Paint & Oil Co., 1244-86 W. 70th St., Cleveland, O.
Troy Engine & Machine Co., Troy, Pa.
Truflo Fan Co., 523 Main St., Harmony, Pa.
Trumbull Electric Mfg. Co., Woodford Ave., Plainville, Conn.
Truscon Steel Co., 1315 Albert St., Youngstown, O.
Tryco Products, Inc., Railroad Sq., Westfield, Mass.
●Tube-Turns, 238 E. Broadway, Louisville, Ky.
Turner Brass Wks., 823-47 Park Ave., Sycamore, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago, Ill.
Tuttle Air Filter Co., Inc., 1014 W. Main St., Louisville, Ky.
●Tuttle & Bailey, Inc., Corbin Ave., New Britain, Conn.
XXth Century Heating and Ventilating Co., Cor. Ira & Edison Aves., Akron, O.

U

U-C Level Indicator Sales, Div. of Marketing, Inc., 828 N. Broadway, Milwaukee, Wis.
●U. S. Air Conditioning Corp., 2101 Kennedy St., N. E., Minneapolis, Minn.
U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles, Cal.
U. S. Electrical Tool Co., 2488-2496 W. 6th St., Cincinnati, O.
U. S. Expansion Bolt Co., P. O. Box 827, State St. & P. R. R., York, Pa.
U. S. Motors Corp., Oshkosh, Wis.
U. S. Stoneware Co., 60 E. 42nd St., New York, N. Y.
Uehling Instrument Co., 473 Getty Ave., Paterson, N. J.
Una-Soft Water Softener Co. 723-725 First National Bank Bldg., Springfield, O.
Underground Steam Construction Co., 73 Pitts St., Boston, Mass.
Unified Air Conditioner Co., Torry Bldg., Duluth, Minn.
Uniflow Mfg. Co., E. Lake Rd., Erie, Pa.
Union Asbestos & Rubber Co., 54th Ave. and 18th St., Cicero, Ill.
Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Union Iron Wks., 1500 Cascade St., Erie, Pa.
Union Metal Wks., Inc., 80 Carter St., Chelsea, Mass.
Union Steam Pump Co., Capitol Ave., S. W., Battle Creek, Mich.
Union Water Meter Co., 333 Hermon St., Worcester, Mass.
United Cork Companies, Central Ave., Kearney, N. J.
United Electric Controls Co., 69 A St., Boston, Mass.
United Metal Hose Co., Inc., 36-01 43rd Ave., Long Island City, N. Y.
United Motors Service Co., General Motors Bldg., Detroit, Mich.
United States Brass & Copper Co., Hyde Park, Boston, Mass.
United States Gauge Co., 44 Beaver St., New York, N. Y.
United States Gypsum Co., 300 W. Adams St., Chicago, Ill.
United States Mineral Wool Co., 9 S. Clinton St., Chicago, Ill.
United States Ozone Co. of America, Crescent St., Scottdale, Pa.
United States Pipe & Foundry Co., Burlington, N. J.
United States Radiator Corp., 1056 National Bank Bldg., Detroit, Mich.
United States Register Co., Burnham St., Battle Creek, Mich.
United States Rubber Co., 1790 Broadway, New York, N. Y.
United States Steel Corp., 436 Seventh Ave., Pittsburgh, Pa.
United Superior Union Co., Inc., 29 Ryerson St., Brooklyn, N. Y.
Universal Air Filter Corp., Duluth, Minn.
Universal Cooler Corp., Marion, O.
Universal-Cyclops Steel Corp., Bridgeville, Pa.
Universal Gypsum & Lime Co., 111 W. Washington St., Chicago, Ill.
Universal Motor Co., 323 Universal Ave., Oshkosh, Wis.
Universal Power Corp., 4300 Euclid Ave., Cleveland, O.
Universal Zonolite Insulation Co., 135 S. LaSalle St., Chicago, Ill.
Uno Ventilator Co., 565 Lincoln Ave., Cliftondale, Mass.
Upson Co., Upson Point, Lockport, N. Y.
USHCO Mfg. Co., Inc., 135 Tonawanda St., Buffalo, N. Y.
Utica Radiator Corp., 2201 Dwyer Ave., Utica, N. Y.
Utility Fan Corp., 4851 S. Alameda St., Los Angeles, Cal.
Utility Laboratory, Inc., 330 36th St., Brooklyn, N. Y.

V

Vacuum Gas Appliances Div., The Union Fork & Hoe Co., Rome, N. Y.
Vanderman Mfg. Co., Mansfield Ave., Willimantic, Conn.
Van Dorn Electric Tool Co., Towson, Md.
Van Noorden Co., E., 100 Magazine St., Boston, Mass.
Vapor Car Heating Co., Inc., 80 E. Jackson Blvd., Chicago, Ill.
Vapor Specialty Co., 101 W. 42nd St., New York, N. Y.
Ventilating Products Co., 2800 Cottage Grove Ave., Chicago, Ill.
Verson Allsteel Press Co., 93rd & Kenwood Ave., Chicago, Ill.
Vesco Corp., 1381 Sedgwick Ave., New York, N. Y.
VibraSeal Corp., 2832 E. Grand Blvd., Detroit, Mich.
Vibration Eliminator Co., 8-22 Astoria Blvd., Astoria, N. Y.
Victaulic Co. of America, 30 Rockefeller Plaza, New York, N. Y.
Victor Electric Products, Inc., 2950 Robertson Rd., Cincinnati, O.
Viking Air Conditioning Corp., 9500 Richmond Ave., Cleveland, O.
Viking Pump Co., Fourth and State Sts., Cedar Falls, Ia.
Viking Shear Co., 1063 W. 19th St., Erie, Pa.
●Vilter Mfg. Co., 2148 S. First St., Milwaukee, Wis.
Vinco Co., Inc., The, 305 E. 45th St., New York, N. Y.
Virginia Smelting Co., West Norfolk, Va.
Vita-Screen Ventilator Co., 103 Park Ave., New York, N. Y.
Vogt Machine Co., Henry, 10th & Ormsby Sts., Louisville, Ky.
Vortex Mfg. Co., 687 N. Tillamook St., Portland, Ore.
Voss Co., J. H. H., 785 E. 144th St., Corner of Wales Ave., New York, N. Y.
Vulcan Electric Co., 88-90 Holten St., Danvers, Mass.
Vulcan Radiator Co., 26 Francis Ave.. Hartford, Conn.

W

Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo.
Wailes Dove-Hermiston Corp., Westfield, N. J.
Waldron Corp., John, New Brunswick, N. J.
Walker Jamar Co., 367 S. First Ave., E., Duluth, Minn.
Wallace Supplies Mfg. Co., 1310 Diversey Pkwy., Chicago, Ill.
Wallace & Tiernan Co., Inc., Belleville, N. J.
Walsh-Holyoke Steam Boiler Co., Holyoke, Mass.
Walsh Refractories Corp., 4070 N. First St., St. Louis, Mo.
Walworth Co., 60 E. 42nd St., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
●Ward Leonard Electric Co., 37 South St., Mt. Vernon, N. Y.
Warlo Corp., 330 W. 42nd St., New York, N. Y.
Warren Electric Appliance Co., Warren Bank & Trust Co. Bldg., Warren, Pa.
Warren Foundry & Pipe Corp., 11 Broadway, New York, N. Y.
Warren Shade Co., Inc., 2905 E. Hennepin Ave., Minneapolis, Minn.
Warren Steam Pump Co., Inc., 300 Bridges Ave., Warren, Mass.
●Warren Webster & Co., 17th and Federal Sts., Camden, N. J.
Washburne & Co., E. G., 207 Fulton St., New York. N. Y.
Water Cooling Corp., 71 Nassau St., New York, N. Y.
Water Cooling Tower Co., 5501 Cornell Ave., Chicago, Ill.
Water Refining Co., 1123 Barthold, Ft. Wayne, Ind.
Waterfilm Boilers, Inc., 154 Ogden Ave., Jersey City, N. J.
Waterloo Register Co., 600 Anita St., Waterloo, Ia.
Watson & McDaniel Co., 440 N. Marshall, Philadelphia, Pa.
●Watson-Stillman Co., 140 Aldene Rd., Roselle, N. J.
Watts Regulator Co., 10 Embankment St., Lawrence, Mass.
Waukesha Motor Co., Waukesha, Wis.
Waverly Heating Supply Co., 31 Union St., Boston, Mass.
Way Loctor Access Panel Co., 420 Boylston St., Boston, Mass.
Wayne Oil Burner Corp., 800 Glasgow Ave., Fort Wayne, Ind.
Weatherhead Co., 300 E. 131st St., Cleveland, O.
Weaver Mfg. Co., Springfield, Ill.
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●Webster Engineering Co., 419 W. Second St., Tulsa, Okla.
Webster Tallmadge & Co., 364 Glenwood Ave., East Orange, N. J.
Wedge Protectors, Inc., 9522 Richmond Ave., Cleveland, O.
Weil-McLain Co., 641 W. Lake St., Chicago, Ill.
Weil Pump Co., 215-17 W. Superior St., Chicago, Ill.
Weinman Pump Co., 290 Spruce St., Columbus, O.
Weirton Steel Co., Weirton, W. Va.
Weiss & Co., H., 113-115 Mercer St., New York, N. Y.

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Weksler Thermometer Corp., 535 Pearl St., New York, N. Y.
Weldex, Inc., 7326 McDonald Ave., Detroit, Mich.
Welding Apparatus Co., 2750 W. Van Buren St., Chicago, Ill.
Western Blower Co., 1800 Airport Way, Seattle, Wash.
Western Chemical Co., 713 Washington St., Kansas City, Mo.
Western Engineering & Mfg. Co., 1726 E. Washington Blvd., Los Angeles, Cal.
●Western Felt Wks., 4029-4117 Ogden Ave., Chicago, Ill.
Western Furnaces, Inc., 950 Commerce St., Tacoma, Wash
Western Hanger Co., 55 New Montgomery St., San Francisco, Cal.
Western Precipitation Corp., 1016 W. 9th St., Los Angeles, Cal.
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Western Venetian Blind Co., 601 W. 26th St., New York, N. Y.
Western Wire & Iron Works, Inc., 945 W. 18th Pl., Chicago, Ill.
Western Wire Products Co., 1415-35 S. 18th St., St. Louis, Mo.
Westfalia Separator Co., 30 Orange St., Bloomfield, N. J.
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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
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Westinghouse Electric & Mfg. Co., Mansfield, O.
Westinghouse X-Ray Co., Inc., 21-16 43rd Ave., Long Island City, N. Y.
Weston Electrical Instrument Corp., 619 Frelinghuysen Ave., Newark, N. J.
Wheatland Tube Co., 606-608 Real Estate Trust Bldg., Philadelphia, Pa.
Wheelco Instruments Co., 1933 S. Halsted St., Chicago, Ill.
Wheeler Mfg. Co., C. H., 19th, Lehigh & Sedgley Aves., Philadelphia, Pa.
Wheeling Corrugating Co., Wheeling Steel Bldg., Wheeling, W. Va.
Wheeling Machine Products Co., Wheeling, W. Va.
Wheeling Steel Corp., Wheeling Steel Corp. Bldg., Wheeling, W. Va.
White & Co., Haydn F., 1740 E. 12th St., Cleveland, O.
White Flo-Matic Corp., 30 Elm St., Hoosick Falls, N. Y.
White Mfg. Co., 2362 University Ave., St. Paul, Minn.
●White-Rodgers Electric Co., 1209 Cass Ave., St. Louis, Mo.
Whiting Stoker Co., 4711-21 W. North Ave., Chicago, Ill.
●Whitlock Mfg. Co., 100 South St., Hartford, Conn.
Whitney Chain & Mfg. Co., The, Bartholomew Ave., Hartford, Conn.
Whitney Mfg. Co., W. A., 636 Race St., Rockford, Ill.
Whitney Metal Tool Co., 110 Forbes St., Rockford, Ill.
Whittington Pump & Engineering Co., 225 S. Meridan St., Indianapolis, Ind.
Wickes Boiler Co., 502 N. Water St., Saginaw, Mich.
Wickes Brothers, 500 N. Tilden St., Saginaw, Mich.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York, N. Y.
Wiedemann Machine Co., 1815 Sedgley Ave., Philadelphia, Pa.
●Wiegand Co., Edwin L., 7610 Thomas Blvd., Pittsburgh, Pa.
Wilcolator Co., 1001 Newark Ave., Elizabeth, N. J.
Wilhelm Co., A., 3rd and Bern Sts., Reading, Pa.
Will-Burt Co., The, Orrville, O.
●Williams & Co., J. H., 225 Lafayette St., New York, N. Y.
Williams Gauge Co., 1620 Pennsylvania Ave., N. S., Pittsburgh, Pa.
Williams, Inc., F. C., 23841-75 Kean Ave., Dearborn, Mich.
Williams Oil-O-Matic Heating Corp., 1201 East Bell, Bloomington, Ill.
Williams & Son, I. B., Dover, N. H.
Williams Valve Co., D. T., Spring Grove Ave. & Township St., Cincinnati, O.
Williamson Heater Co., 337 W. Fifth St., Cincinnati, O.
Williamsport Engine & Machine Co., 1306 Memorial Ave., Williamsport, Pa.
Willis Steel Corp., 156 N. Academy St., Galesburg, Ill.
Willson Products, Inc., 348 Thorn St., Reading, Pa.
Will-Weld Mfg. Co., Inc., 1501 Jackson St., Omaha, Nebr.
Willy's Carbide Tool Co., 1340 W. Vernor Highway, Detroit, Mich.
Wilson & Co., 4100 S. Ashland Ave., Chicago, Ill.
Wilson Co., H. A., The, 105 Chestnut St., Newark, N. J.
●Wilson, Inc., Grant, 4115 W. Taylor St., Chicago, Ill.
Wilson-Rumsey Plant, K. R., Seneca Falls, N. Y.
Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York, N. Y.
●Wing Mfg. Co., L. J., 14th St. & 7th Ave., New York, N. Y.
Wipe-On Corp., 105 Hudson St., New York, N. Y.
Wiss & Sons Co., J., 33 Littleton Ave., Newark, N. J.
Witte Engine Works, 1600 Oakland St., Kansas City, Mo.
Wittenmeier Machinery Co., 850-860 N. Spaulding Ave., Chicago, Ill.
Wodack Electric Tool Corp., 4627 W. Huron St., Chicago, Ill.
Wolff & Munier, Inc., 222 E. 41st St., New York, N. Y.
Wolverine Tube Co., 1455 Central Ave., Detroit, Mich.
Wood Conversion Co., 1981 First National Bank Bldg., St. Paul, Minn.
Wood's Sons Co., T. B., 1275 Fifth Ave., Chambersburg, Pa.
Wooster Art Wood, Inc., P. O. Box 198, Wooster, O.
Worner Products Corp., 1019 W. Lake St., Chicago, Ill.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Worthington-Gamon Meter Co., Harrison, N. J.
Wright-Austin Co., 315 W. Woodbridge St., Detroit, Mich.
Wyckoff & Son Co., A., 100 Home St., Elmira, N. Y.

X

X Laboratories, Inc., 25 W. 45th St., New York, N. Y.
X L Refrigerating Co., 1834 W. 59th St., Chicago, Ill.
X-Pando Corp., 4315 Thirty-Sixth St., Long Island City, N. Y.

Y

Yale & Towne Mfg. Co., Stamford, Conn.
Yardley Screen & Weather Strip Co., 138 Parsons Ave., Columbus, O.
●Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.
Yates-American Machine Co., Beloit, Wis.
Yeomans Bros. Co., 1470 N. Dayton St., Chicago, Ill.
Yoder Co., The, 5500 Walworth Ave., Cleveland, O.
York Corrugating Co., Adams St. & W. M. R. R., York, Pa.
●York Ice Machinery Corp., Roosevelt Ave., York, Pa.
York Oil Burner Co., Inc., P. R. R. & Jessup Pl., York, Pa.
Yost Mfg. Co., Meadville, Pa.
Young & Bertke Co., 1004-1014 Hulbert Ave., Cincinnati, O.
●Young Radiator Co., 709 Mead St., Racine, Wis.
Young Regulator Co., 4500 Euclid Ave., Cleveland, O.
●Youngstown Sheet & Tube Co., Stambaugh Bldg., Youngstown, O.

Z

Zallea Brothers & Johnson, Taylor and Locust Sts., Wilmington, Del.
Zapon-Brevolite Div., Atlas Powder Co., North Chicago, Ill.
Zeh & Hahnemann Co., 182-200 Vanderpool St., Newark, N. J.
Zenith Electric Co., 607 S. Dearborn St., Chicago, Ill.
●Zink Co., John, 4401 S. Peoria St., Tulsa, Okla.
Zobell Electric Motor Corp., 96 South Ave., Garwood, N. J.

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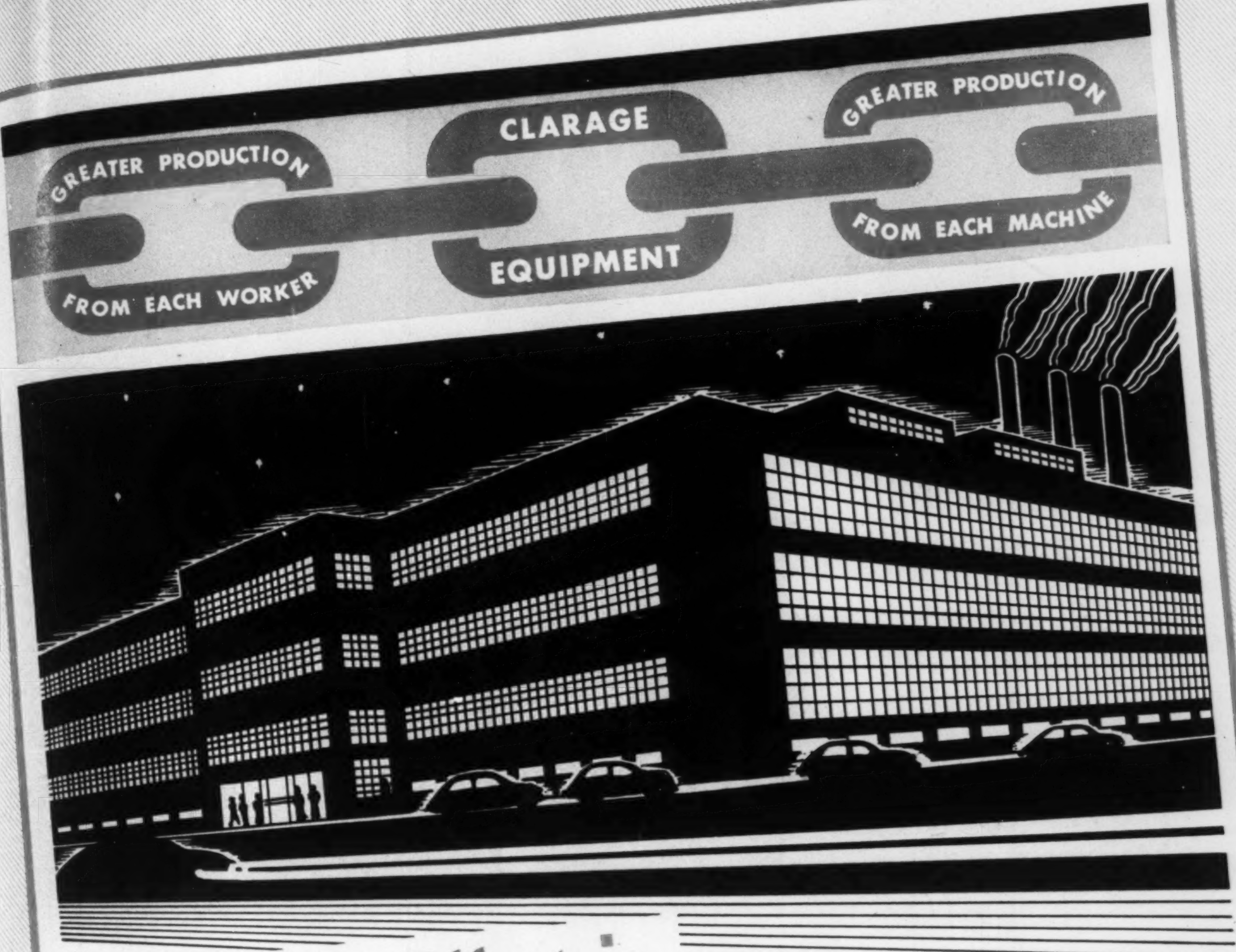
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